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Houston-Galveston Area Council, TX

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IMPLEMENTATION REQUIREMENTS

APRIL 1978

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IMPLEMENTATION REQUIREMENTS

AREAWIDE WASTE TREATMENT MANAGEMENT PLAN
FOR THE
GREATER HOUSTON AREA
(SECTION 208, PL 92-500)

APRIL 1978

REVISED AUGUST 1978

PREPARED FOR THE HOUSTON-GALVESTON AREA COUNCIL
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The objective of Implementation Requirements is to develop a detailed presentation of major actions which must be taken to bring about implementation of the technical recommendations of the Areawide Waste Treatment Management Plan (pursuant to Section 208, P.L. 92-500) for the Greater Houston Area. Additionally, Implementation Requirements identifies the designated management agency(ies), recommended as part of the management plan, required to initiate the major actions and monitor their progress. This report provides step-by-step procedures to be followed in order to 1) convert the existing recommendations into reality, 2) guide plan update studies, and 3) incorporate update activities into new or revised plan recommendations.

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FOREWORD

The Areawide Waste Treatment Management Plan for the Greater Houston Area (pursuant to P.L. 92-500) has been in preparation since mid 1975. This report Implementation Requirements is the final output of the initial plan. The plan was submitted to the Texas Department of Water Resources for State Certification review in April 1978.

It should be understood that actions occurring after initial plan submittal are not reflected in the reports. For example, subsequent to plan development, the Texas Department of Health Resources was changed to the Texas Department of Health. Additionally, the Clean Water Act of 1977 (P.L. 95-217) was passed by the Congress and supersedes the provisions of the Federal Water Pollution Control Act Amendments of 1972 (P.L. 92-500) under which the plan was developed.

It is the intention of the 208 process to recognize and incorporate actions by the State and Federal governments that impact the plan. An important aspect of the annual plan updates will be to reflect new institutional and legal arrangements as well as the addition and evaluation of current base data.

Revisions to this report since April 1978 were made to reflect comments from the State Review Process that related to errors or lack of clarity in the initial submittal. These revisions were minor in nature and do not attempt to reflect new or updated information.

8/22/78

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CHAPTER I INTRODUCTION

CHAPTER I INTRODUCTION

General

One of the unique features of Section 208 of PL 92-500 is that the Areawide Waste Treatment Management Plan be implemented. This requirement is perhaps the most important feature of the 208 program.

This report attempts to combine the technical recommendations with a recommended management system to provide the capability for implementing the 208 program. It is this management feature that distinguishes the 208 program from previous water quality planning efforts. Additionally, it provides the mechanism to effectively transform the existing 208 outputs into a dynamic ongoing water quality management plan for the Greater Houston-Galveston Area.

Purpose and Scope

The objective of the Implementation Requirements report is to develop a detailed presentation of major actions which must be taken in order to bring about implementation of the recommended technical plan. Additionally, this report identifies the designated management agency(ies), recommended as part of the management plan, required to initiate the major actions and monitor their progress.

This report is a critical component to the overall 208 Areawide Waste Treatment Management Plan as it provides step-by-step procedures to be followed in order to 1) convert the existing recommendations into reality, 2) guide plan update studies, 3) incorporate update activities into new or revised plan recommendations. The actions and procedures detailed herein are presented for the entire 208 planning area. Specific implementation items are further detailed on a segment-by-segment basis.

Other Reference Material

Many of the previous reports issued throughout the 208 program have provided valuable input during the development of the Implementation Requirements report. In addition to the various background materials often referred to as the "data base" (such as population/land use and projections, wasteload inventories and projections, simulation models, etc.) several reports were utilized for significant details during the development of this document. Among these are the following:

1) Control Strategies, Costs & Impacts For Point Sources, July, 1977.

2) Current Wastewater Management, May, 1977
Revised November, 1977.

3) Alternative Management Systems, November, 1977.

4) Alternative Technical Subplans, December, 1977.

5) Summary Report, Areawide Waste Treatment Management Plan for the Greater Houston Area, December, 1977.

6) Areawide Waste Treatment Management Plan Summary, March, 1978.

Report Organization

Information contained herein is presented first in an introductory chapter including background, references, methodologies, and a summary of the management plan utilized throughout the development of the implementation requirements. Next, common requirements and programs applicable to the entire 208 drainage basin are discussed. These items include; 1) regulatory and compliance functions, 2) water quality planning, 3) construction and operation functions, 4) nonpoint source control authority.

Specific implementation items that relate to individual subbasins are presented in Chapters III, IV, and V for segments in the greater drainage basins of Lake Houston, Clear Lake, and the Houston Ship Channel respectively.

Financing of point source controls, coordination requirements, and planning requirements are detailed in Chapters VI, VII, and VIII respectively. Chapter IX then presents the overview for implementation activity and scheduling.

Methodology

Information and assumptions utilized in the development of the implementation requirements are based on methodologies presented in the previously referenced documents. However, during the 208 program, questions continually surfaced concerning the accuracy of the capital and operational and maintenance costs for both plant and collection systems. Therefore, the original methodology, for estimating cost data has been revised for application to this report. A review of the 208 program cost data and methodology is contained in the Appendix.

Management Plan Summary

As previously noted, one of the unique aspects of Section 208 provisions is the requirement that the plan specifically identify those agencies to be responsible for plan implementation. These agencies which make-up the management system and their responsibilities are summarized below:

- Regulatory and compliance functions will be the responsibility of the Texas Department of Water Resources. Responsibility includes; setting stream quality and effluent quality standards, issuing point source discharge permits, monitoring for compliance with permits and standards, and enforcement to assure compliance with regulations.
- Water quality planning will be the responsibility of the Houston-Galveston Area Council. Responsibility includes; update of 208 plan for annual certification, short and long range comprehensive water quality planning, public participation and interrelationships with other physical planning programs (for example, parks and recreation, transportation, housing, etc.).
- Wastewater treatment operation functions will be the responsibility of present system operators (such as Cities, Water Districts, San Jacinto River Authority, Gulf Coast Waste Disposal Authority and private operators) coordinated through a local mechanism to be further defined. Responsibilities include; construction and operation of wastewater treatment facilities, development of 201 facility plans and raising revenues for capital and operating costs.
- Nonpoint source control will be the responsibility of the presently existing authorities on both the State and local level with local coordination.
- It is recommended that a local mechanism be created for coordination of water quality activities. These functions focus on coordination of implementation of water quality programs at the local level. It will formalize relationships between operators, regulatory agencies and interest groups while affixing primary responsibility for progress toward 208 goals. Activities will include regional water quality policy setting, recommendation of action

priorities, sharing of technical expertise, guiding implementation of nonpoint programs and providing local input to Federal and State programs.

In the interim period, prior to the formation of a local coordinating council, the Texas Department of Water Resources will assume the responsibility for coordination.

CHAPTER II COMMON REQUIREMENTS AND PROGRAMS

CHAPTER II COMMON REQUIREMENTS AND PROGRAMS

Introduction

In order to implement the 208 plan several types of efforts are required. The efforts which apply specifically to individual basins are presented in Chapters III through V. This chapter presents programs which apply more generally to the entire study area. In some instances reference is made to subsequent chapters for greater detail.

Regulatory and Compliance Functions

General

The following regulatory and compliance functions are addressed:

- Permitting
- Monitoring
- Standards
- Enforcement

For the most part the subsections are developed as follows: Summary of existing function, effects of the 208 plan on the function, and changes in the function resultant from the plan.

Permitting

Existing Permitting Program. The existing permitting program is administered at the State and federal levels. The Texas Department of Water Resources (TDWR) represents the State in the National Pollutant Discharge Elimination System (NPDES) of the U.S. Environmental Protection Agency (EPA).

1) Federal. EPA plays a central role in the administration of water quality matters. The agency was created in 1970 by Executive Order and has the general mandate to consolidate the federal government's various approaches to the control and improvement of the environment. Under the Federal Water Pollution Control Act Amendments of 1972 (FWPCAA), EPA was given wide authority to implement environmental control and improvement strategies. EPA administers the FWPCAA and has direct review authority over Section 208 planning.

EPA has numerous responsibilities in the administration of water quality matters. EPA establishes effluent standards, administers a number of planning programs, reviews receiving stream standards, administers Section 201 construction grants, pursues enforcement activities, and coordinates water quality planning with other programs of EPA and other federal agencies.

In addition, EPA is charged with administering the Section 402 National Pollutant Discharge Elimination System (NPDES) permit. This permit is the mechanism for the implementation of the effluent discharge standards established by EPA. EPA has delegated this permit program to the State but must review the State program since it has not been certified. The program has not been certified because the penalty provisions of the Texas Water Quality Act are less severe than those of the FWPCAA. However, it appears that the new consolidation act will meet the EPA standards. Discharge permits are issued for five years, with the conditions generally being determined by the EPA effluent guidelines.

2) State. The TDWR is authorized by the Texas Water Quality Act to issue permits for the discharge of wastewater from point sources either into or adjacent to waters in the State, and to obtain detailed information in the form of a permit application from each person intending to discharge into State water courses. No point source may discharge without a permit, and no person may commence construction of a treatment facility until the Department has issued a discharge permit for the facility.

It is the Department policy that no permit is to be granted if the cumulative discharges into any stream segment are in excess of the calculated assimilative capacity of the given segment. These wasteloads have been computed for all stream segments which violate water quality standards based on two year, seven day low flows. Each municipal sewage treatment facility in these stream segments is assigned an effluent set based upon the recommendations of the wasteload evaluation report. Table II-1 contains a list of the effluent sets as defined by the TDWR. As a result of this "pollution budget" concept, State discharge standards may be more stringent than those imposed by EPA. It appears that the permitting function is being exercised adequately, although the relationship of permit issuance to wasteload allocations needs to be researched in more detail.

TABLE II-1

TDWR EFFLUENT SETS

Effluent Set	Level of Treatment (mg/L)			
	BOD	TSS	NH_3-N	P
0	30	30	-	-
1	20	20	-	-
2	10	15	-	-
3	5	10	-	-
4	5	5	-	-
2N	10	15	5	-
3N	5	10	5	-
4N	5	5	3	-
3P	5	10	-	2
4P	5	5	-	1

3) Other. The State and federal governments, represented by the Texas Department of Water Resources (TDWR) and the U.S. Environmental Protection Agency (EPA), bear the main burden of issuing permits for point source discharges. Other State and local agencies also participate in the permitting process. The Texas Department of Health Resources approves on the design of treatment facilities. The Railroad Commission issues permits (for brine discharges to estuarine waters from oil well operations and for wastewater discharges from certain petroleum processing plants), municipalities (industrial waste ordinance and/or pretreatment requirements), and Corps of Engineers (permits for dredging operations including spoil disposal). The Gulf Coast Waste Disposal Authority reviews and may comment on TDWR permitting activities. Counties may, subject to the written approval of the TDWR, establish permitting systems for private sewerage facilities. The San Jacinto River Authority (SJRA) has the authority to issue pretreatment permits to industrial dischargers who use waste treatment facilities owned by the SJRA. Other local input is limited to the review and comment process.

Permitting and wasteload allocation are closely tied insofar as permitting is the regulatory process by which wasteload allocations are implemented. This subject is discussed under the Wasteload Allocation subsection.

208 Plan Effects on Permitting. While the permitting function will remain with existing entities, the 208 plan will affect the permitting function in several ways.

The most apparent way that the 208 plan will effect the permitting function is recommendations relative to new parameters. Inclusion of the ammonia requirement for effluent set 2 plants, setting of maximum chlorine requirements for plants, and setting of minimum dissolved oxygen requirements for wastewater treatment discharges are the three new parameters of note. Minimum effluent dissolved oxygen requirements are of particular significance since dissolved oxygen concentrations equal to or greater than stream standards may be required. In order to properly implement these items, the following must be achieved:

- Conduct technical studies, as appropriate, to verify the need for changes.
- Re-evaluation of the changes based on the technical studies.
- Request TDWR to make changes.
- Conduct the hearing and other processes required to finalize changes.

Further information on these programs is contained in the Appendix.

Another effect of the 208 plan is that certain non-parametric recommendations of the 208 plan can be best implemented through the permitting function. An example of this is the Cypress Creek recommendation that new plants be constructed at effluent set 2N with the flexibility to meet effluent requirements as stringent as 4N with post aeration. The ideal way to assure that such provisions are made is through the permitting process.

Summary. In summary, the permitting function will still rest with EPA and TDWR and no actions are required in that regard. However, the 208 plan should affect the content of permits. A local coordinating committee could serve as a catalyst towards making recommended changes a reality.

Monitoring

Existing Monitoring Program. Of all the 208 functions, monitoring is probably the most confusing. Agencies at every governmental level, ranging from EPA down to local water districts, are authorized to engage in the monitoring process. The reasons for these authorizations vary tremendously and reflect the specific goals of each monitoring agency. In some cases it is used by the enforcement agencies to determine whether treatment operations are producing effluent within legal limits. In other cases it can be to test for health purposes or for compliance with adopted plans or other State standards. Given the many uses of water within the State, it is unlikely that the current complex multi-jurisdictional monitoring system is going to be radically changed by the 208 program. It is recommended, however, that distribution of authority and sharing of information among agencies will avoid duplication and reduce the high costs of future water quality monitoring efforts.

1) Federal. At present, responsibility for monitoring is shared by a number of agencies. On the federal level, EPA has the authority to monitor both discharge and stream water quality. The Houston EPA office exercises this power in only a limited way. EPA sampling and analysis of water quality in the Houston area has been confined to evaluating discharges of municipal and industrial waste where particular problems have been identified and routine but infrequent inspection of major dischargers. In addition, EPA receives self-reported discharge data from a variety of point source dischargers as well as State collected data.

2) State. The major responsibility for water quality monitoring has been allocated to the State, specifically, the new Texas Department of Water Resources (TDWR). Under Section 26.014 of S. B. 1139 (the act that created the new Department) the Texas Water Commission and the Department of Water Resources staffs are entitled to enter upon any public or private property at any reasonable time for the purpose of inspecting and investigating conditions relating to the quality of water in the State. In addition, under Section 26.042, the TDWR is the agency directly responsible for establishing a water quality sampling and monitoring program for the State. The program includes both stream water quality and effluent water quality monitoring.

The primary discharge monitoring tool, however, is the "self-reporting" system, in which the discharger sends reports on effluent quality to TDWR. The Board of the TDWR may proscribe reasonable requirements for a person making waste discharges to monitor and report on waste collection, treatment, and disposal activities. The discharger is responsible for collecting discharge quality monitoring data and for reporting the data to TDWR. In addition, all spills of hazardous materials must be reported to TDWR. The basic self-reporting system remains as a primary monitoring mechanism under the 208 plan.

Actual monitoring activities carried out directly by the TDWR are delegated to the TDWR district offices. Stream monitoring is pursued at designated points at certain frequency intervals and discharge quality monitoring is coordinated with EPA discharge monitoring. The Department also has the ability to monitor effluent quality on a random basis for long or short periods of time. In addition TDWR conducts salinity studies of major bays and estuaries of the State, special studies of ground water quality, including well sampling, and surface water studies in cooperation with the United States Geological Survey.

The other major State agency involved in the monitoring process is the Texas Department of Health Resources (TDHR). TDHR is mainly concerned with public health issues such as solid waste disposal, safe drinking water, and shellfish sanitation testing. TDHR samples and analyzes stream water to determine bacterial concentrations, and tests municipal water systems as part of their certification process. In addition, TDHR monitors bacterial concentration in bays and estuaries to delineate shellfish harvesting areas. TDHR's monitoring activities are expected to increase with the implementation of the Safe Drinking Water Act, which will necessitate greater inter-agency coordination.

3) Local. On a regional level, several regional agencies share monitoring responsibilities. These are the Gulf Coast Waste Disposal Authority, the Clear Creek Basin Authority, and the San Jacinto and Brazos River Authorities. Houston-Galveston Area Council (H-GAC) has no authority to monitor either discharge or stream water quality.

The Gulf Coast Waste Disposal Authority (GCWDA) was created by the Texas Legislature as a regional water pollution abatement authority with jurisdiction in Chambers, Harris, and Galveston Counties. The primary purpose of GCWDA is to provide regional waste treatment facilities and regulation at the regional level.

GCWDA has the authority to make inspections and investigations on public and private property, including watercraft, and to evaluate conditions relating to water quality and waste disposal. The results of such investigations are to be reported to TDWR. To date, however, GCWDA has limited itself to monitoring its own treatment facilities and will continue to do so under the 208 plan.

The Clear Creek Basin Authority (CCBA) is a Conservation and Reclamation District and has jurisdiction over the Harris County portion of the Clear Creek Watershed. CCBA is primarily involved in monitoring and enforcement activities. The CCBA monitors wastewater discharge quality by collecting samples and having them chemically analyzed.

The San Jacinto River Authority (SJRA) and the Brazos River Authority (BRA) were created by special legislative acts. Both agencies are authorized to collect monitoring data related to stream water quality, and to make analyses related to drinking water quality. The Authorities collect water quality samples and analyze them for water supply purposes and for compliance with State water quality criteria. They are also involved in self-reporting of the quality of effluent discharge from their own treatment facilities.

On a local level, monitoring responsibility within the 208 area is divided between the counties and the cities. In Harris County, which makes up most of the designated 208 planning area, the monitoring function is vested in the Harris County Pollution Control Department (PCD). The focus of this monitoring program is to investigate citizen complaints relative to air and water discharges. Monitoring is done by "grab sample" to gather evidence for legal action if the individual situation warrants it. In addition to investigation of specific complaints, the PCD does random samplings of major wastewater discharges. Further, the monitoring function is performed by the Harris County Flood Control District which monitors water quality in conjunction with the U. S. Geological Survey.

Because of its size and geographic area, the Houston monitoring program is extremely important. The City of Houston, through the Water Pollution Control Section of the City Health Department (WPCS), has a major effluent and water quality monitoring system. The WPCS monitors effluent quality both from municipal treatment sources on a self-reporting basis as well as from the non-municipal sources. The City's water quality program provides data for stream segments that are not monitored by TDWR. Further, a study to monitor and analyze the quality of Lake Houston water as a supply of drinking water has been funded through and undertaken by this division. The City of Houston has a well equipped laboratory and large staff for its monitoring program.

Other cities in the 208 planning area, both home rule and general law cities, share the responsibility for monitoring both stream water quality and effluent discharges with agencies at the State and county level. Cities are authorized to monitor stream and effluent water quality in order to insure the general health and welfare of the community.

208 Plan Effects on Monitoring. The responsibility for monitoring will still rest with the agencies now responsible for the function, with primary responsibility resting with TDWR. However, the 208 plan will affect the function in several ways.

One effect of the 208 plan is that it recommends additional stream quality monitoring to generate a data base on wet weather water quality. Additionally, more emphasis on heavy metals and other toxic materials is recommended for plan update with water quality monitoring recommended to focus this effort.

A second effect of the 208 plan on monitoring is that effluent discharge monitoring must be expanded to be consistent with additional and/or more stringent permit requirements.

A final effect of the 208 plan is that it seeks to create a mechanism by which local efforts relative to monitoring can be coordinated with each other and, ultimately, with the State efforts.

In order to properly implement the above items, the following should be achieved:

- Conduct discussions with the State to determine what elements of the expanded stream monitoring program the State will undertake.
- Arrange for the conduct of the remaining monitoring through local agencies, special studies under ongoing planning, demonstration grants or other means.
- Initiate a mechanism by which all of the monitoring being accomplished in the study area can be reviewed and recommendations made for improvement to assure the accuracy and validity of the assembled data.
- Conduct further discussions with the State to determine whether certain aspects of their monitoring efforts should be conducted by the coordinated local agencies under the direction of the TDWR.
- Evaluate stream monitoring locations and suggest possible new sites at critical points.

The monitoring system currently in use in the 208 planning area is a complex and costly one. The 208 plan calls for an increased monitoring program as part of the enforcement and implementation process. Total costs related to monitoring are expected to rise. This fact, together with the lack of coordination in the present system, indicates that changes in the present system are essential to implementation of the monitoring facet of the 208 plan. The technology for a sophisticated monitoring system is available, but financing and administering such a program are problems that must be solved.

One area of specific interest in the 208 program's monitoring component is related to increased local input. In those parts of the region where alternative pollution control strategies have been recommended for testing, it is recommended that monitoring programs be developed jointly by the TDWR and local communities in order to evaluate the impact of such pollution abatement techniques on a test basis.

Summary. In summary, the primary monitoring responsibility function will still rest with TDWR. This monitoring function must be expanded in certain respects, some of the expansion of effort should be performed locally. The coordination of the rather extensive monitoring activities being undertaken by various agencies could be performed locally.

Standards

Existing System. Standard setting has been a State responsibility in the past, and is expected to remain primarily a State responsibility in the future. Standards established by the State will, however, be subject to the review and approval of EPA and review and input from local water quality entities. This approach will assure large-scale jurisdictional coverage and consistency in State water quality matters.

1) State. The State of Texas has the authority to set its own water quality standards for waters within the State. The Texas Department of Water Resources (TDWR) is the State agency given the primary responsibility for implementing the provisions of the constitution and the laws of the State of Texas relating to water quality. Section 21.975 of the Texas Water Code gives the Department clear legal authority to set water quality standards for the waters of the State and to amend them as required. The Department has exclusive authority to set stream and discharge standards, subject to EPA review and approval.

The TDWR established standards for point source discharges, consistent with EPA criteria, through its discharge permit program. It is Department policy that discharge permits may not be granted if the cumulative discharges into any stream segment are in excess of the assimilative capacity of the given stream segment.

Before setting or amending stream water quality standards, the Board of TDWR is required to: (1) hold public hearings at which any person may appear and present evidence for consideration by the Board, and (2) consult with the Executive Director to ensure that the proposed standards are consistent with the objectives of the State Water Plan.

The TDWR is expected to exercise this authority in compliance with the EPA's National Pollutant Discharge Elimination System (NPDES).

Standards are periodically reviewed and changes may be made after a public hearing. Standards are to be upgraded over time in order to reflect the 1983 goal of the Federal Water Pollution Control Act Amendments of 1972, that all waterways shall be "fishable and swimmable".

Another State agency with responsibility for water quality standards is the Texas Department of Health Resources (TDHR). The TDHR sets standards for drinking water quality, and establishes criteria for municipal solid waste disposal; the Department is consulted by the TDWR on the establishment of bacterial concentration standards for water quality.

2) Federal. While the primary responsibility for the establishment of water quality standards rests at the State level, the U. S. Environmental Protection Agency (EPA) is required by sections 301, 302, 305, 307, 308 and 403 of P.L. 92-500 to establish guidelines for all point source discharges. These discharge guidelines are of three types: (1) a 1977 dishcarge standard defining Best Practicable Control Technology Currently Available (BPCTCA): (2) a 1983 discharge standard defining Best Available Technology Economically Achievable (BATEA): and (3) Best Available Control Technology (BACT). BPCTCA and BATEA apply to existing point sources, and the BACT standard applies to new dischargers. The Clean Water Act Amendments of 1977 now speak to the implementation of Best Conventional Treatment (BCT) by 1984.

In addition to this responsibility for setting effluent guidelines, the regional EPA office has the responsibility of reviewing and approving the stream standards set by the State of Texas. Such a review may lead to a request for changes in State standards.

3) Local. Government agencies on the regional and local level have a very limited role in the standard setting process. A number of agencies may participate in standard setting through the review and comment process.

The Gulf Coast Waste Disposal Authority (GCWDA) has the statutory authority to set water quality standards and criteria subject to approval by the TDWR. To date, however, GCWDA has not chosen to exercise this authority.

River Authorities have no authority to set water quality or discharge standards. Through their involvement in the 303 planning process, they may make recommendations regarding such standards, but these recommendations have no impact on water quality unless enacted by TDWR and approved by EPA.

Cities incorporated under the laws of the State of Texas may not set stream standards. Cities are involved in making recommendations on TDWR's establishment of standards. In addition, cities have extensive powers to indirectly influence stream quality through the selective control of land development and through ordinances related to water quality issues.

208 Plan Effects on Standards. The major responsibilities for setting standards will remain at the State level with TDWR. However, several actions are called for in the 208 plan requiring coordination

of efforts and local inputs. These actions pertain to both dry and wet weather conditions.

For example, Armand Bayou has been recommended for classification. As a result of this, the TDWR will be responsible for setting dry weather standards consistent with fishable/swimmable water quality.

Another example is Buffalo Bayou which has also been recommended for classification, but not as a fishable/swimmable segment. Water quality criteria consistent with non-contact recreation and preservation of bayou aesthetics should be determined for the bayou. Major input to the water quality criteria should be on a local level through voluntary coordination. Recommendations, developed locally, should then be sent to the TDWR for review and implementation.

A third example of 208 recommendations affecting dry weather water quality standards is the Houston Ship Channel. Overall water quality remains a question. Studies, detailed in subsequent sections, have been recommended to determine whether or not it is economically feasible to attain and maintain fishable/swimmable water quality in the Ship Channel. Based mainly on the results of the wet weather monitoring program, alternate water quality standards and segment uses may be required. These alternate criteria should be reviewed locally and implemented by the TDWR.

Wet weather water quality standards are a new concept, recommended in the 208 plan. These need to be defined for the 208 area. Numerical standards which will protect stream segments for those same uses on which dry weather standards were determined need to be developed.

In order to properly implement the recommendations affecting water quality standards in the 208 area, as described in the above examples, the following must be achieved through planning and coordination:

- Discussions with the State, local governments and other associated groups concerning the numerical standards and parameters for newly classified or reclassified segments.
- Coordination of local input for numerical standards and parameters for segments classified or reclassified segments.
- Coordination of local input for numerical standards and parameters for segments classified for "non-contact recreation and preservation of bayou aesthetics."

- Coordination of local input for redefining water usage in cases where it is not technically or economically feasible to achieve the existing water quality criteria.
- Develop data base supporting or justifying numerical values and parameters for wet weather conditions.
- Conduct further discussions with the State and EPA and provide follow-up coordination during the review of new or altered standards.

The State will continue its major responsibilities in setting water quality standards under the 208 plan. The State has adequate financial resources to continue this rôle, and possesses the specialized technical competence required to perform this function. There is, however, some controversy concerning the standard setting process and the standards imposed. This controversy concerns the numerical standards necessary to meet the water quality goals of P.L. 92-500 and the impact that such standards would have if adopted. It is not always clear what degree of effluent reduction is necessary to meet the federal "fishable/swimmable" goals, or what level of control technology is required by P.L. 92-500. Most of the debate on this subject occurs outside of the region, at the State and federal levels.

Public input is encouraged throughout the standard setting process; it is difficult, however, to secure meaningful public participation in this process because of its technical nature. The public does become involved if regional or national goals as expressed in water quality standards interfere with local goals. Standard setting can also produce political problems if the public feels that the financial burden imposed by a water standard is excessive. There may be a gap between the goals of the federal government and of local citizens; both must be evaluated in light of cost realities.

Summary. In summary, the prime responsibility for setting and certifying water quality standards will remain a State function. However, local conditions suggest the need to develop some new standards and to reassess some existing standards in light of the 208 plan recommendations. Studies to answer some of the questions concerning local needs, situations and recommendations would be implemented by TDWR with local review. Additionally, ongoing coordination with State and local entities and concerned interest groups should be provided.

Enforcement

Existing System. Enforcement of the 208 plan will require the use of a broad array of devices since implementation of the plan will undoubtedly require a complex strategy. At present, enforcement of discharge standards for wastewater treatment is a complex process. The agencies which play a major role in the enforcement process include the U. S. Environmental Protection Agency (EPA), the Texas Department of Water Resources (TDWR), the Texas Attorney General's office (AG), the City of Houston, the Gulf Coast Waste Disposal Authority (GCWDA) and the Harris County Pollution Control Department. In addition, the counties and the Clear Creek Basin Authority participate in enforecement.

1) Federal. EPA is authorized by Section 209 of the Federal Water Pollution Control Act to file either criminal or civil actions to enforce its National Pollutant Discharge Elimination System (NPDES) permits. Provisions exist for injunctive relief, civil penalties ranging from $2,500 to $50,000 per day and imprisonment for terms up to two years. These sanctions are more severe than those available under Texas law; however, EPA generally defers enforcement actions to State and local jurisdictions for political and practical reasons.

2) State. The TDWR is also involved in enforcement activities. Enforcement action may be pursued in one of two ways. Minor violations may be met with citations which are turned over to the District Attorney's office for prosecution. In cases of more serious violation, the discharger is called in for an enforcement hearing. If an agreement can be reached regarding action which will bring the facility into compliance, then the TDWR will issue an order setting a time limit for compliance. If an agreement cannot be reached, then the TDWR may institute court proceedings through the Attorney General's office to compel compliance. Subchapter E of Section 21.251 of the Texas Water Code outlines the sanctions that may be requested of the Texas Attorney General's office, including fines of not less than $50 nor more than $1000 per day of violation, or injunctive relief, or both.

The Texas Attorney General's office (AG) prosecutes violations of the State water quality laws and regulations which are requested by the TDWR or other government entities. The AG may independently prosecute water quality offenders under the common law, but has no authority to independently prosecute violations of State water quality laws and regulations.

3) Local. The City of Houston is the primary enforcement agency in the 208 area. Houston is actively enforcing wastewater management programs within the City's incorporated areas and its extraterritorial jurisdiction (ETJ).

The City's Water Pollution Control Division files approximately 400 suits each year. First samples are obtained, analyzed and compared to standards set by the City, the TDWR and EPA. Any noncompliant dischargers are contacted. If such a contact fails to produce the necessary changes, the violation is referred to the City Legal Department. When necessary, the Legal Department files criminal or civil suits against offending dischargers. In some instances, such enforcement action may be taken by the State.

Fines levied by the City of Houston are limited by Texas Law and are lower than State and federal fines. These lower fines are less effective at encouraging compliance and are insufficient to defer the cost of data collection and prosecution. The City may retain half of all civil fines, and TDWR, which is generally a co-complainant, retains the other half. Criminal fines are remitted in total to the State. Still, the City Legal Department prefers criminal actions because they are less costly and more effective in encouraging future compliance.

The Gulf Coast Waste Disposal Authority (GCWDA) is another agency authorized to enforce State water quality standards. Violations of GCWDA rules, permits and orders are punishable by penalties of up to $1000 per day of violation, or by injunctive relief.

The enforcement responsibilities of the Harris County Pollution Control Department extend over a major portion of the 208 area. Harris County has historically taken an active role in the enforcement of wastewater discharge permits (particularly industrial). Generally, criminal suits are filed with the County District Attorney's office for legal action. The procedures employed by Harris County are available to other counties in the 208 area. Galveston County also pursues a vigorous enforcement program.

The Clear Creek Basin Authority (CCBA), is active in enforcement of waste discharge permits. The CCBA has successfully prosecuted a number of suits against permit violators in the past.

Counties have the authority to enforce the provisions of the Texas Water Quality Act. Counties generally pursue enforcement of water standards by seeking criminal prosecution for noncompliance with wastewater discharge permits. Suits are forwarded from the county to the County District Attorney's office.

208 Plan Effects on Enforcement. The 208 water quality calculations and resulting recommendations are based on the assumption that all point source discharges will meet permit requirements at projected flows. Therefore, enforcement programs are important to attaining the "fishable/swimmable" goal. Two streams for enforcement emphasis are Cypress Creek and Clear Creek.

The existing entities responsible for enforcement will remain the same. However, as noted above, there is a major need to coordinate the enforcement effort. Participants in a water quality council may be able to identify or project areas within the 208 planning boundary that are critical and therefore in need of close enforcement control. Development of nonpoint source controls can also be coordinated locally. Recommended studies, detailed in subsequent sections, call for analyzing all nonpoint controls presently in effect in the area. A water quality council can serve as a clearinghouse for local nonpoint source control program development and implementation.

In order to properly implement the recommendations affecting enforcement of existing or future permit conditions, the following actions must occur:

- Discussions with all existing enforcement entities in the 208 area in order to develop a methodology to coordinate and record enforcement activity.
- Development of a methodology to incorporate monitoring data, self-reporting data, and land use patterns to project areas where future enforcement activities should be directed.
- Institute the recommended program to collect and analyze data pertaining to all existing nonpoint source control programs operating in this area.
- Evaluate existing and recommended nonpoint source control programs in order to implement the proven control techniques.

Summary. Effective enforcement of the 208 plan will require coordination in the present complex system. The existing system is costly and perhaps wasteful due to overlapping efforts, although this system does provide a backup enforcement process. Present penalties and fines lack uniformity and cannot pay for the enforcement process. New and increasingly technical rules will require a greater degree of sophistication in equipment, staff and technology.

The 208 plan recommendations do not affect the present enforcement responsibilities in the area. The emphasis is on coordination of point source enforcement activities, implementation of nonpoint source control programs, and identification of critical areas requiring close monitoring/enforcement.

Water Quality Facility Planning

General

The following water quality facility planning items are addressed as part of the implementation requirements:

- Wasteload allocations
- Priority system
- 201 planning
- Continuing planning and special programs

Wasteload Allocations

Existing Mechanism. Wasteload allocations are determined by the State. The method involves the development of a wasteload evaluation of the particular stream segment including, the total wasteload capacity of the segment during the defined critical conditions and the existing wasteload contributed from both point and nonpoint sources. The above inputs can be developed from assumed conditions, measured conditions, through the use of computer simulation models, or any combination of the above.

The result of the stream segment evaluation is to assign an allowable loading to each point source discharger to the segment. Typically, all municipal discharges to a stream segment are assigned discharge permits with identical effluent criteria i.e. level of sewage treatment (see Table II-1). In some cases especially where major discharges are concerned, stricter effluent standards are assigned due to the local effects on segment water quality.

New Allocations. The 208 plan cites the need for possible changes in effluent limits in several of the segments. These are discussed in detail in the appropriate section for each affected basin. Also included in the 208 plan are stream segment simulations depicting areas in existing segments with potential excess assimilative capacity.

The possible changes in effluent limits cited in the plan are based on the water quality simulation models and the input data utilized in the 208 program. The continuing planning process calls for verification of these items. Details of the ongoing planning and special programs are contained elsewhere in this report.

Role of Management System. Local entities can play a role in cost effectively distributing and maintaining the wasteload allocation.

Examples of local inputs enabled through coordination include:

1) Improved utilization of excess assimilative capacity in existing segments.

2) Variable effluent water quality based on noncritical stream conditions.

3) Continuous review of coordinated monitoring data for recommendation and alternatives of existing allocations.

4) Review of new permit applications to supply input and recommendations for alternate discharge locations.

5) Balancing the effects of nonpoint source wasteloads and point source wasteloads in order to utilize the segment capacity to its maximum without jeopardizing the prescribed water quality.

By implementing the above activities, considerable cost savings could be achieved throughout the 208 planning area. For example, in the Cypress Creek basin, municipal discharges are presently permitted at effluent set 2N. The 208 plan cites the possibility that effluent set 4NA may be required to meet fishable/swimmable water quality. Possibly, only those contributing to the critical point or points in the segment may require upgrading while others could remain at effluent set 2N. If a mechanism were available to share the savings due to variable effluent limits within a basin, this type of approach for wasteload allocations could be extremely attractive to the area.

Another example of how local coordination of systems operations could be cost effective is through the use of variable treatment levels during noncritical stream conditions. Wasteload allocations are based on the 2 year, seven day low flow. These allocations are designed by definition to protect the fishable/swimmable water quality of the segment for critical flow conditions that occur once every two years on the average. Additionally, the allocations are based on summer water temperatures of 85^{o}- 90^{o}F which increase the wasteload degradation rate and decrease the oxygen solubility in water. In short, wasteload allocations protect the stream segment even if extreme hydrological conditions occur.

It is conceivable that during noncritical stream conditions a far greater amount of waste could be assimilated by the segment without adverse effects. A coordinated monitoring effort (previously discussed) could result in identification of areas which have excess assimilative capacity. The result would be a recommendation to the TDWR that certain discharges could by-pass some unit operations in their treatment system, such as effluent filters or chemical addition, during these noncritical conditions.

Summary. In summary, the recommendations of the 208 plan will not affect the existing State wasteload allocation evaluation system, as a basis for maintaining fishable/swimmable water quality during critical flow conditions. Emphasis is placed on providing for local input into this State function.

Priority System

Existing Priority System. A draft copy of the State's priority rating process is available at the H-GAC and the TDWR.

208 Plan Effects on Priority System. The proposed management system provides for coordination of local projects, thereby assisting entities in obtaining higher priority ratings. For example, by having the overall picture in the area, a water quality council could promote large regional treatment facilities which are likely to achieve a higher priority since a greater number of citizens will be served.

Areas of local input to the priority process include:

- Review of areas of local input to the State's priority formulation to determine if there are deficiencies or arbitrary elements which impact on local agencies abilities to obtain funds.
- Review TDWR basis for numerical elements which are used in priority formulation. For example, some local stream segments may be rated on a lower priority than justified.
- Review grant applications at pre-grant stage and calculate likely priority. Determine changes in grant request (e.g.-expand Facility Planning Area) which could increase priority or "piggy-back" a low priority area with a high priority area.
- Through local coordination, agencies could combine their grant requests or achieve regionalization and thereby achieve higher priority.
- Review list of eligible/ineligible items for federal funding to determine if changes are needed to implement the 208 plan.

Summary. In summary, the initial recommendations of the 208 plan will not affect the State priority ranking system. The 208 plan will only affect the data base on which the State ranks local projects. The goal is to increase the weighting on factors that can be altered within the area through coordinated planning and thereby increase the benefit to the citizens along with the number of citizens receiving benefits.

201 Planning

Existing 201 Planning. A list of the existing 201 facility planning projects in the 208 area is available at the TDWR and the H-GAC. The existing 201 priority list will be applied without any modification during the first year. Included in the list are the State ranking, the phase of the project, and the estimated project cost for the remaining phases. This report endorses the legal authority of those entities in the Greater Houston 208 area presently included in the 201 construction grants priority list for the State of Texas. Those agencies are therefore to be designated as waste treatment management agencies with requisite authority to receive Federal funds for sewerage improvements.

208 Plan Effects on 201 Planning. The eligibility of entities to receive future Federal construction grants will be evaluated by the planning agency at preapplication state. A statement of legal authority for grant eligibility and management agency designation will be included as part of A-95 review of step 1 applications. The proposed management system will have a similar impact on 201 planning as it will have on the State priority system. Several of the advantages that can be provided through local coordination are:

- Recommendations to entities for enlarging or combining facility planning areas.
- Recommendations to entities for alternate method for providing sewage treatment such as entering an existing facility with excess capacity.
- Coordination of areas not presently fundable with areas that are fundable in order to regionalize treatment systems.
- Review 201 Step 1 applications and make recommendations concerning possible alternatives.
- Review 201 Facility Plans for compliance with 208 plan recommendations, such as, those in Cypress Creek.

Summary. After approval of a 208 plan, the Administrator of the Environmental Protection Agency shall not make any grant for the construction of publicly owned treatment works under Section 201 of the Clean Water Act except to designated agencies and for works in conformity with the approved plan. The 208 plan will also impact on the local scene by recommending coordination of facility planning areas, sewage treatment alternatives, regionalization of facilities, and review of plans for compliance with the 208 program.

Special Programs

The 208 plan includes many broadly defined recommendations concerning items to be pursued during the continuing planning process. The items discussed include:

- special studies
- model verification
- model expansion and development
- standard setting
- data base verification
- data base updates
- test programs

A list of programs to be implemented during the continuing planning process is included in Table II-2. Additional data included in the Table are the affected basins within the 208 area, implementing agencies, and the priority. The priorities are ranked as follows:

A. Highest Priority. Irreversible commitments and negative environmental effects without data (initiate immediately).

B. Plan decisions affecting major resource allocation dependent upon results (initiate as priority A commitments allow).

C. Continual/on-going effort (initiate mechanisms, intensify in future).

D. Required as part of plan implementation but not critical (initiate after A and B).

E. Necessary to plan update (initiate in time for plan update).

An expanded description of the programs in Table II-2 is contained in the Appendix. Whenever possible, the following information has been included in the expanded description.

- Purpose
- Scope
- Inputs

TABLE II-2
CONTINUING PLANNING AND SPECIAL PROGRAMS

Program	Location	Emphasis and Application	Priority[1]	Prime Responsibility
Update Steady-State water quality simulation models	Spring Creek	Nitrification in Creek to Determine Need of NH_3-N Effluent Requirement	B	TDWR
	Cypress Creek	Magnitude and source of Benthal Oxygen demand. Feasibility of meeting existing standards.	B	TDWR
	Clear Creek	General (i.e. degradation and rate constants and other parameters)	B	TDWR
	San Jacinto	Effects of Houston Ship Channel. Development of Benthic loads.	E	TDWR
	Armand Bayou	Develop Model	E	TDWR
	Dickinson Bayou	Develop model for entire basin. Emphasize ammonia effects.	E	TDWR
	Ship Channel	Extend model to major tributaries. Re-verify based on existing conditions. Emphasize Benthal Oxygen Demand and nitrification.	E	TDWR
Wet weather water quality monitoring	Spring, Cypress, San Jacinto	Verify prediction of existing modeling simulation (i.e. no wet weather problems).	E	Local Agencies
	Clear Creek	Monitor wet weather water quality as first step of model verification.	A	Local Agencies

TABLE II-2 (cont'd)

CONTINUING PLANNING AND SPECIAL PROGRAMS

Program	Location	Emphasis and Application	Priority[1]	Prime Responsibility
	Ship Channel	Determine feasibility of meeting fishable/swimmable during wet weather	B	Local Agencies
	Armand, Buffalo	Develop data base prior to classification	D	Local Agencies
Update nonsteady-state water quality simulation models	Spring, Cypress, San Jacinto, Armand, Buffalo	Possible action items based on wet weather water quality monitoring results.	E	TDWR
	Clear Creek	Verify model and wasteload inputs. Quantify target reduction to detail control strategies.	A	TDWR
	Ship Channel	If monitoring indicates fishable/swimmable may be achieved, verify model and wasteload inputs. Quantify target reduction to detail control strategies.	E	TDWR
Wet weather standards evaluation	All Classified Segments	Determine parameters and numerical values consistent with water uses on which dry weather standards are based.	A	TDWR
Dry weather standards evaluation	Armand	Determine water quality standards as part of classification process	D	TDWR

CONTINUING PLANNING AND SPECIAL PROGRAMS

Program	Location	Emphasis and Application	Priority[1]	Prime Responsibility
	Buffalo	Determine water quality standards consistent with noncontact and preservation of bayou aesthetics.	D	Local Agencies/ TDWR
	Ship Channel, Cypress, Clear	Evaluate alternate water quality standards and uses based on results of wet weather programs.	E	Local Agencies/ TDWR
	Spring, Cypress, Clear, Lake Houston, Armand, Dickinson	Determine maximum chlorine residual standard consistent with a healthy aquatic environment.	E	TDWR
Update point source inventory	All	Maintain accurate and up-to-date data base to assist in future planning efforts.	E	H-GAC
Update population and land use	All	Maintain accurate updated data base. Emphasis on computerization so alternate data sources can be easily evaluated and integrated. Application: to re-evaluate allocations, nonpoint source wasteloads, predict problem areas, identify deviation from existing data base and projections to focus future planning efforts.	C	H-GAC
Update nonpoint source wasteload	All	Emphasize dry weather contribution. Incorporate into existing steady-state models where applicable.	E	H-GAC

TABLE II-2 (cont'd)

CONTINUING PLANNING AND SPECIAL PROGRAMS

Program	Location	Emphasis and Application	Priority[1]	Prime Responsibility
Eutrophication	Lake Houston	Verify plan recommendations.	E	City of Houston
	Clear Lake, Dickinson	Emphasize total phosphorus loading including sources. Determine effects of alternate phosphorus loadings on eutrophication. Application: to determine cost effectiveness of existing point source phosphorus controls.	A	TDWR
Ongoing planning for Regionalization Opportunities	All	Emphasize utilization of 201 Programs to evaluate regionalization. Evaluate Facility Planning Areas during pre-grant application phase.	C	H-GAC/201 grantees
Evaluate Supplemental aeration	Ship Channel	Determine effect and cost-effectiveness on Ship Channel dissolved oxygen levels. Application: alternate method of achieving water quality standards.	E	GCWDA
Inter-basin transport evaluation	Clear Creek	Determine cost-effectiveness, acceptability and environmental impact of transporting wastewater out of Clear Creek watershed to alternate watersheds. Application: may assist in achieving stream standards in Clear Creek.	B	201 grantees
Determine impacts of additional water quality pollutants	All	Emphasize in stream levels of heavy metals and other toxic materials, as well as suspended solids. Application: focus on-going planning.	E	TDWR

TABLE II-2 (cont'd)

CONTINUING PLANNING AND SPECIAL PROGRAM

Program	Location	Emphasis and Application	Priority[1]	Prime Responsibility
Analyze nonpoint source controls	Clear Creek	Select test areas to evaluate impact of nonpoint source controls on wet weather pollutant loadings. Application: develop detailed technical subplans.	A	H-GAC/local agencies
Evaluate desirability of classification of bayous	Ship Channel	Emphasize water uses and cost-effectiveness	E	H-GAC/ TDWR
Evaluate non-water quality impacts of nonpoint source	All	Emphasize erosion and flood control, as well as transportation air quality and other environmental programs. Application: Interface with all environmental programs, as required by 208.	E	H-GAC/local agencies
Coordinate designated and non-designated area	All	Evaluate both plans and endeavor to coordinate them and their implementation	C	H-GAC/local agencies
Nonpoint ordinance Analysis	All	Collect and analyze all nonpoint controls now in effect in order to develop a refined nonpoint program.	D	H-GAC
Map all water districts	All	Inventory and map all existing water districts and service areas.	E	H-GAC

TABLE II-2 (cont'd)

CONTINUING PLANNING AND SPECIAL PROGRAMS

Program	Location	Emphasis and Application	Priority[1]	Prime Responsibility
Environmental planning interface	All	Coordinate 208 plans and implementations with other environmental programs including air quality, transportation, solid waste, 201 and 303, and CZM.	D	H-GAC/ local agencies

Notes:

1. A - Highest Priority - Irreversible commitments and negative environmental affects without data (Initiate immediately).

   B - Plan decisions affecting major resource allocation dependent upon results (Initiate as priority A commitments allow).

   C - Continual/on-going effort (Initiate mechanisms, intensity in future).

   D - Required as part of plan implementation but not critical (Initiate after A and B).

   E - Necessary to plan update (Initiate in time for plan update).

- Outputs

- Suggested Methodologies

- Agencies

- Approximate Cost

Summary. The 208 plan to date must not be viewed as a completed process. Continuing planning is required to justify many of the conclusions and recommendations. Therefore, implementation of the special programs as prioritized herein is considered vital to the satisfactory implementation of the 208 program.

Construction and Operation

Construction Phasing

Facilities to be constructed and other factors relating to point source discharges are anticipated to be a major activity on an areawide basis. Continued implementation of both industrial and municipal control will be required.

Industrial point source discharge controls are governed by Federal regulations and will be scheduled and financed by the private sector. Therefore, no definitive estimates of the timing or costs involved with implementation of industrial point source discharge controls have been made in this program.

It should be noted that industrial wasteload projections utilized during the development of alternative subplans were based on industry achieving "Best Available Treatment" (BAT) by 1983. Recent actions by the Federal Government have delayed a final decision on implementation of the 1983 goals. Although the delay of BAT is not anticipated to create any major water quality problems in the 208 area, the effects of the increased wasteloads on the stream criteria should be determined during ongoing planning.

Construction activities for municipal facilities relating to point source discharges are based on a combination of inputs including:

1) Upgrading of existing wastewater treatment facilities from present conditions to those required by 208 recommendations.

2) Expansion of existing facilities to handle the projected growth within currently served areas.

3) New facilities currently in the planning stage under existing programs.

4) New facilities required based on population projections and land use.

A segment by segment description of anticipated construction activities and/or other controls necessary to implement the selected subplans are developed for three time periods: the present through 1983, 1984 through 1990, and 1991 through 1995. Construction activities and their associated costs are discussed and tabulated in subsequent chapters. A discussion concerning the costing methodology is contained in the Appendix.

Operation and Maintenance

Proper O&M of existing and future sewage treatment and conveyance facilities is of prime importance to the validity of the selected 208 Waste Treatment Management Plan. Water quality simulation modeling was based on the premise that all point source discharges will meet their permit requirements at the projected flow volumes.

The level of O&M activity will vary between service areas. Factors affecting the O&M effort include, but are not limited to:

1) Level of treatment

2) Raw wastewater characteristics

3) Contribution of industrial wastewater

4) Number and type of unit processes

5) Plant layout

6) Productivity of labor

7) Climate

8) Level of training

9) Level of automation

10) Laboratory requirements

11) Off-plant maintenance

12) Age and condition of equipment

13) Age and condition of collection system

14) Infiltration and inflow contribution

15) Size of service area

The estimated costs associated with annual operational and maintenance expense is based on proper control on a daily basis by trained personnel. The following tasks and capabilities are typical responsibilities generally considered necessary to properly operate and maintain a sewage treatment plant and conveyance system on a daily basis.

1) Operations Task

- operation of process equipment, valves, pumps engines, and generators
- cleaning of clarifier weirs, bar screens, and other items necessary for proper unit process function
- taking of sewage samples as required
- operation of electrical controls (timers, etc.)

- monitoring of gauges, meters, and control panels
- recognition of process upsets, and of critical conditions in unit processes
- determination of treatment process condition using lab data, meter, and gauge readings
- mixing of any chemicals required in treatment
- inspection of plant for overall process condition
- field investigations for sources of infiltration and inflow including smoke testing, physical inspection, rainfall simulation, flow quantification, preparatory cleaning and internal inspection

2) Maintenance Task

- lubricate equipment and check for modifications
- replace packing in pumps and valves
- service and replace bearings in motors and other equipment
- install and start-up new equipment
- clean out pipes (sludge lines)
- calibrate and repair meters and gauges
- inspect and service mechanical and electrical control systems (timers, level controllers, etc.)
- cleaning and inspection of sewers and lift stations

3) Supervisory Task

- regular inspection of plant operation and maintenance
- organization and direction of training programs
- formulation of budget and control of expenditures
- development of plans and procedures to insure efficient operation and maintenance
- reporting to authorities on the operation and expenditures of the plant
- maintenance of good public relations
- preparation of work schedules, shift staffing, and operations
- evaluation of operation and maintenance records

4) Clerical Task

- maintaining operation and maintenance records
- maintaining shift logs and meter readings
- filling out regulatory agency forms, discharge reports, operation reports, and staff reports
- maintaining reports on operating expenditure and financial records
- routine correspondence, posting, filing and sorting

5) Laboratory Task

- collection of samples

- performance of laboratory analyses
- assembling and reporting of data from tests
- evaluation of data in terms of plant performance
- preparation of common chemical reagents and bacteriological media.
- recommending process changes based on laboratory data

6) Yardwork

- driving, loading and unloading of sludge trucks and other equipment
- gardening, grass cutting, trimming shrubs, watering, etc.
- washing of equipment and tools
- cleaning and polishing of floors, walls, furniture, etc.

Existing Operation and Maintenance. In the 208 area, there is presently a wide range in the efficiencies and effectiveness of operational and maintenance procedures. Sewage treatment plant management ranges from fully staffed facilities operating with three shifts of trained and licensed operators, performing all the tasks identified above, to small plants that are visited once per week to determine if any mechanical failures have occurred. Recommendations included as part of the 208 programs are to "actively promote proper operation and maintenance of wastewater treatment facilities in conformance with permit requirements."

208 Plan Effects on Operation and Maintenance. The impacts of the 208 plan recommendations for proper operation and maintenance can be divided into two categories, those involving water quality and those involving cost. Only positive impacts on water quality are anticipated from improved operation and maintenance of municipal wastewater treat-

ment facilities as compared to the present level of control. The positive impacts on water quality can be related to such items as:

1) improved effluent quality
2) reduced levels of chlorine residual
3) reduced levels of pathogenic bacteria
4) lower occurrence of plant upset due to process or mechanical failure
5) reduction of bypasses and overflows throughout the service area

The impact on cost for improved operation and maintenance of sewage treatment facilities will be to generally increase the operating expenses. Additional costs will be incurred for such items as:

1) additional staffing
2) manpower training
3) utilities and chemicals
4) sludge handling and disposal
5) additional control systems
6) increased laboratory analyses
7) identification and repair of infiltration and inflow sources

However, some increased operational and maintenance activities can reduce the overall expenses. For example, savings can be achieved in reduced chlorine usage through the use of flow control feedback systems, instead of setting chlorine dosage for peak flow. Additionally, active infiltration/inflow reduction programs can eliminate a significant amount of extraneous flow to the treatment plant thereby reducing the overall treatment cost.

General programs considered necessary to properly operate and maintain a wastewater collection and treatment system include but are not limited to:

1) Operator training. This can be performed in several ways such as; on the job training, home study courses, continuing education seminars, etc. Operator training should be directed toward enhancing knowledge and achieving certification.

2) Preventative maintenance. A detailed preventative maintenance program outlining specific tasks to be performed on a regularly scheduled basis should be developed to incorporate the unique characteristics of each wastewater treatment service area. The maintenance program should pay special attention to automatic control and monitoring systems which are often overlooked once they are installed.

3) Infiltration/Inflow. A continuous program to quantify, evaluate, and rehabilitate sources of extraneous flow to the wastewater treatment plant will greatly improve the operation within the service area. In addition to reducing the direct cost of sewage treatment, infiltration/inflow abatement can eliminate health and aesthetic nuisances due to surcharging overflows, and bypasses. Additionally, pipe and road damage attributable to washout of soil bedding caused by a combination of infiltration and exfiltration can be greatly reduced through proper monitoring techniques. An infiltration/inflow evaluation procedure incorporating portions of the planning process, is an integral part of a total operation and maintenance program.

Role of the Management System. Through the sharing of expertise in a water quality council, input can be provided on a voluntary basis to treatment plant operators concerning operational and maintenance procedures.

Authority for Nonpoint Souce Controls

While the extent of the need for a program to control nonpoint sources of water pollution has not yet been established, a survey of existing authority for nonpoint source controls is essential to the 208 planning process. The analysis of available nonpoint source controls presented here shows which agencies have the authority to effect a control program once the extent of the need for specific nonpoint controls is established.

Existing agencies are authorized to impose a variety of regulations that could reduce causes of nonpoint pollution such as erosion, sedimentation, and urban runoff. A variety of mechanisms including subdivision controls, building codes, solid waste disposal regulations, and septic tank controls are available for use in a nonpoint source control program. It is unlikely that zoning ordinances will be a major part of such a program because of the unique nature of the Houston area.

Federal

Federal involvement in nonpoint source control has been limited. The U.S. Environmental Protection Agency (EPA) has the most responsibility over nonpoint sources, but has limited direct authority in this area. EPA's role has recently been expanded by the case of Natural Resources Defense Council versus Train (396 Fed. Supp. 1393 (1975)). As a result of this litigation, EPA was ordered to expand its National Pollutant Discharge Elimination System (NPDES) permit program to include agricultural operations and separate storm sewers. EPA has issued regulations for separate storm sewers, but is appealing the case. The new regulations greatly expand the potential scope of EPA's NPDES program. However, nonpoint source controls are generally applied locally, and it seems unlikely that EPA would want to expand its manpower resources to take on a heavy involvement in nonpoint source regulation.

State

The Texas Department of Water Resources (TDWR) also has limited authority over nonpoint source control. TDWR has authority over feedlots and septic tanks in areas not suited to the use of septic tanks. In addition, through the review and approval of the creation of utility districts, TDWR may have authority to control facility and drainage plans. This authority has not been utilized and would apply only to new water districts seeking approval for the use of proceeds from bonds.

Also on the State level, the Texas Department of Health Resources has authority to issue permits for sanitary landfills and municipal solid waste disposal systems.

In addition, the Texas Railroad Commission (TRC) controls water quality aspects of the oil and gas industry in the State. TRC supervises and enforces the laws and rules related to conservation and prevention of waste in the production of oil and gas. The Commission issues permits for drilling and for conversion of wells for disposal of oil and gas waste. The Commission, and not the TDWR, has control of the discharge of waste from oil and gas exploration activities. Pipeline oil and hazardous material spills are reported to the TRC.

Local

Authority on a regional level is shared by a number of agencies. The Gulf Coast Waste Disposal Authority has legal authority to regulate solid waste disposal and septic tanks. The San Jacinto River Authority and the Brazos River Authority can issue septic tank permits, an authority delegated by the State.

The Clear Creek Basin Authority (CCBA) has no authority to permit point source discharges, but has claimed authority to control some nonpoint sources and has adopted stormwater run-off regulations to become effective on May 1, 1978. The imposition of such controls may lead to litigation, since the authority of the CCBA is not clear in this regard.

Soil and Water Conservation Districts (SWCD's) have experience concerning nonpoint source control problems and solutions. There are five (5) SWCD's with jurisdiction in the 208 area. District offices are located in Houston, Rosenburg, Huntsville, Waller, and Angleton, Texas. The SWCD's have been most actively involved in disseminating information and technical assistance concerning soil erosion prevention and run-off abatement techniques. Programs have traditionally been conducted on a voluntary basis.

On a local level, counties have some authority to regulate nonpoint sources. Counties may review subdivision plats for street width, design, paving, and drainage considerations. It is not clear whether such reviews can be used as nonpoint source controls; county authority to exercise development controls seems to be limited to flood-related controls.

Cities in Texas have no specific power to regulate nonpoint sources, but have substantial authority to control land development both within the city limits and in the extraterritorial jurisdiction. A number of controls including septic tank ordinances, flood-related regulations, subdivision plat review, the building code, and other city ordinances may be used to control nonpoint pollution sources. Subdivision platting review may be the best suited to nonpoint source control. The use of this review process to pursue water quality goals is clearly authorized by the Texas Constitution.

The City of Houston is probably the agency with the most potential in the area of nonpoint source controls. Houston currently exercises authority over septic tanks and certain flood-related controls. Houston also reviews subdivision plats, but there is no ordinance requiring plat approval before developing. Such an ordinance would have to be passed before the City could undertake a major role in nonpoint source control.

Existing authorities for point and nonpoint source controls are to be coordinated through a water quality council mechanism. A high priority shall be assigned to learning more about the impacts of nonpoint sources and the effectiveness of corrective measures.

Summary

It is clear from this discussion that many mechanisms exist which may be used to control nonpoint sources of water pollution. However, no coordinated legal program exists to integrate these various approaches to nonpoint source control. Formation of a local water quality coordinating mechanism can assist in answering the needs in this area.

Any proposed program for nonpoint source control could encounter several major problems. First, the costs of both structural and nonstructural solutions may be high. Because nonpoint source controls are relatively new, cost estimates and funding methods must still be established.

Political acceptability of nonpoint controls is another problem. The political climate in Houston is not very receptive to land development control and other types of nonpoint source controls. Agencies which attempt to institute nonpoint controls, especially those that affect land development practice, may encounter strong resistance. An extensive effort to educate public officials and the community concerning the benefits of nonpoint source pollution control may be required.

CHAPTER III LAKE HOUSTON SUBBASIN

CHAPTER III - LAKE HOUSTON SUBBASIN

Spring Creek (Segment 1008)

Technical Subplan

Point Sources. The technical subplan for point source discharges includes the following:

1) Operate existing and future wastewater treatment facilities at the existing permit levels.

2) Consider regional treatment facilities if warranted by future population patterns and economic justifications.

3) Consider adopting effluent standard of 8.0 mg/1 of NH_3-N for use in permits where more restrictive levels do not apply.

4) Consider maximum limits on chlorine residual in plant effluents.

Nonpoint Sources. Nonpoint source wasteloads were not projected to be a major concern. The technical subplan encourages the use of best management practices to reduce the amount of nonpoint source pollutants washed to the stream.

Other. Additional recommendations for the Spring Creek segment include:

1) Implement monitoring program to update and verify the dry weather model.

2) Implement monitoring program to update and verify the conclusions of the wet weather model.

3) Formulate wet weather standards consistent with the fishable/swimmable water quality goal.

Impact on Regulatory Function

Permitting. The 208 program recommends that the existing level of permitted discharge in the Spring Creek segment be continued. The general level throughout the basin is effluent set 2 (BOD=10 mg/1 and TSS=15 mg/1) except for the Woodlands which is permitted at modified effluent set 4P (BOD=5 mg/1, TSS= 5 mg/1, and P=2 mg/1).

The major impact on permitting in the Spring Creek segment relates to the new parameters considered for control. These parameters include ammonia-nitrogen and chlorine residual. The recommendation for adopting an ammonia-nitrogen standard of 8.0 mg/l where more restrictive levels do not apply is further developed in the section pertaining to special programs and activities in Chapter II.

Permits for maximum chlorine residual should be considered in order to protect Spring Creek and its aquatic environment from the possibly toxic effects of excessive chlorine and the formation of chlorinated hydrocarbons. Limiting chlorine residuals is especially important in the Spring Creek area due to the natural state of the Creek and the fact that the Creek is tributary to Lake Houston, a major drinking water reservoir.

Monitoring. Monitoring efforts in the Spring Creek segment will continue to assess the segment water quality and the effluent quality through the existing mechanisms. Additional monitoring in Spring Creek should be directed toward verification of inputs, assumptions, and conclusions developed during the technical subplanning process. Included among these items are two major items: population/land use and wet weather water quality.

Stream Standards. Dry weather standards for water quality in Spring Creek are recommended to be consistent with fishable/swimmable water quality criteria for the 208 area (i.e. D.O. $\geq$ 5.0 mg/l and fecal coliform less than 200 MPN/100 ml).

Wet weather water quality standards have not yet been defined for Spring Creek. However, a special program has been defined as the basis for developing the wet weather water quality criteria, including parameters and numerical values, consistent with water uses on which the dry weather standards are based. This program is further described later in this section.

Allocations. The 208 plan recommends that the existing wasteload allocations developed by the TDWR be continued in the Spring Creek segment. However, these allocations are based on an unverified water quality simulation model and the assumption that effluent ammonia-nitrogen concentrations of 8.0 mg/l will result from level 2 treatment. If ammonia-nitrogen concentrations are significantly greater than 8.0 mg/l and if the special activity (described in the following section) concerning nitrification in Spring Creek indicates a dissolved oxygen problem in the Creek, wasteload allocations may require redefinition by the TDWR. This stream has been classified by the TDWR as Water Quality (WQ) Limited.

Special Activities Required to Implement

A complete list of the continuing planning and special programs included as part of the 208 recommendations was presented in Chapter II. Programs specific to the Spring Creek segment are summarized below. A complete description of the program is contained in the Appendix.

1) Update the steady-state water quality simulation model. In addition to verifying the inputs and rate constants, special emphasis should be directed toward nitrification in the Creek. This will enable a decision to be made concerning the need for ammonia-nitrogen limits for permitted discharges.

2) Monitor wet weather water quality in order to verify the conclusions of the storm water simulation model.

3) Update the nonsteady-state water quality simulation model if wet weather monitoring efforts do not verify the model's conclusions.

4) Determine wet weather water quality standards. Parameters and numerical values should be consistent with fishable/swimmable water uses.

5) Determine maximum chlorine residuals which will be consistent with fishable/swimmable conditions; consider modifying permits accordingly.

6) Update the point source inventory in the basin. Emphasis should be directed toward maintaining accurate and up-to-date information that is easily updated. This will provide input to future planning efforts.

7) Update the population and land use data. Emphasis should be on computerization of data base to allow greatest flexibility of the data. Applications of this activity include re-evaluation of allocations, nonpoint source wasteload evaluation, problem area prediction, etc.

8) Update nonpoint source wasteload identification and projections. Emphasis should be directed toward dry weather contributions in the basin. Information

developed should be incorporated into the existing steady-state model where applicable.

9) Evaluate regionalization opportunities in the segment. Emphasis should be on coordination of the 201 program and evaluation of planning areas during the pre-grant application phase.

10) Determine impacts of other pollutants on Spring Creek water quality. Emphasis should be on heavy metals and toxic materials as well as suspended solids.

11) Evaluate impacts of nonpoint source wasteloads on a basis other than the effects on water quality. Emphasis should be directed toward erosion, flood control, transportation, air quality, etc. The results will be used to interface with other environmental programs as required by 208.

12) Coordinate the nondesignated area 208 plan with the designated area 208 plan in order to efficiently implement the recommendations.

13) Monitor and analyze all existing nonpoint source controls in the Spring Creek area. Emphasis should be on cataloguing controls and evaluating performance in order to develop a data base for a refined nonpoint source control program throughout the area.

14) Inventory and map all existing water districts and service areas in the segment. This effort will be part of the updated data base for ongoing planning.

15) Coordinate 208 plans and implementations with other environmental programs including air quality, transportation, solid waste, 201, 303, and parks/recreation projects.

Phasing and Costs

Population and land use projections were utilized as the basis for projecting the future wastewater treatment and conveyance system facility needs in the Spring Creek segment. Table III-1 presents the phasing for three distinct time periods, for new municipal facilities broken down by geographical planning areas. (A description and maps of geographical planning areas are contained in the Alternative Technical Subplans report). Table III-2 presents the associated cost estimates, both capital and operational and maintenance, for the projected facilities, also on a geographical planning area basis.

In Spring Creek, projected new facility construction for the 1977-1983 time period includes:

1) Eleven new treatment plants with a total projected capacity of 2.28 MGD average daily flow.

2) Two plant expansions increasing capacity by an additional 5.45 MGD.

3) New collection systems serving an additional 81,860 persons.

Facilities projected for the 1984-1990 time period include:

1) One new treatment plant with a capacity of 0.2 MGD.

2) One plant expansion from 0.25 to 0.34 MGD.

3) Additional collection systems serving 10,790 persons.

Facilities projected for the final time period, 1991-1995, include:

1) One new plant with a capacity of 0.1 MGD.

2) One plant expansion from 0.15 to 0.18 MGD.

3) New collection systems serving an additional 7,640 persons.

The associated estimated costs for capital expenses and operational and maintenance expenses are summarized in Table III-3.

TABLE III-1
SPRING CREEK
SCHEDULE OF PROJECTED CONSTRUCTION NEEDS

Geographical Planning Area	Plant Or Service Area	Existing Capacity Treatment Level	Projected Construction Needs			Estimated Dry Weather Flow/ Total Capacity Available (MGD)				Comments
			1977-1983	1984-1990	1991-1995	1977	1983	1990	1995	
SC-1	New Plant 1	-	New plant at 0.1/2 Collect - 1000	-	-	0.0/0.0	0.1/0.1	0.1/0.1	0.1/0.1	
	New Plant 2	-	New plant at 0.1/2 Collect - 300	Collect - 400	Collect - 300	0.0/0.0	0.03/0.1	0.07/0.1	0.1/0.1	
SC-2	New Plant 3	-	New plant at 0.2/2 Collect - 1300	Collect - 400	Collect - 300	0.0/0.0	0.13/0.2	0.17/0.2	0.2/0.2	
SC-3	New Plant 4	-	New plant at 0.7/2 Collect - 6700	Collect - 300	-	0.0/0.0	0.67/0.7	0.7/0.7	0.7/0.7	
	New Plant 5	-	-	New plant at 0.2/2 Collect - 1500	Collect - 500	0.0/0.0	0.0/0.0	0.15/0.2	0.2/0.2	
	New Plant 6	-	-	-	New plant at 0.1/2 Collect - 1000	0.0/0.0	0.0/0.0	0.0/0.0	0.1/0.1	
SC-4	Tomball	0.25/2	Collect - 670	Expand to 0.34/2 Collect - 260	Collect - 190	0.18/0.25	0.24/0.25	0.3/0.34	0.34/0.34	
	New Plant 7	-	New plant at 0.17/2 Collect - 1400	Collect - 200	Collect - 100	0.0/0.0	0.14/0.17	0.16/0.17	0.17/0.17	
SC-5	New Plant 8	-	New plant at 0.06/2 Collect - 500	Collect - 100	Collect - 50	0.0/0.0	0.05/0.06	0.06/0.06	0.06/0.06	
SC-6	New Plant 9	-	New plant at 0.05/2 Collect - 400	Collect - 50	Collect - 50	0.0/0.0	0.04/0.05	0.05/0.05	0.05/0.05	
SC-7	Dowdell	0.3/2	Collect - 350	Collect - 100	-	0.03/0.3	0.05/0.3	0.06/0.3	0.07/0.3	
SC-8	New Plant 10	-	New plant at 0.06/2 Collect - 500	Collect - 100	-	0.0/0.0	0.05/0.06	0.06/0.06	0.06/0.06	
SC-9	Norchester	0.43/2	Collect - 1500	Collect - 510	Collect - 360	0.21/0.43	0.36/0.43	0.40/0.43	0.43/0.43	
SC-10	HC WCID 1	Abandon existing plant	New plant at 0.45/2 Collect - 1000	Collect - 700	Collect - 400	0.25/0.3	0.33/0.45	0.4/0.45	0.45/0.45	Based on Facility Plan information
SC-11	Encanto Real	0.15/2	Collect - 130	Collect - 120	Collect - 80	0.01/0.15	0.01/0.15	0.02/0.15	0.03/0.15	
SC-12	HC MUD 6 (Woodlands)	1.5/4P	Expand to 6.0/4P Collect - 55,000	-	-	1.5/1.5	6.0/6.0	6.0/6.0	6.0/6.0	Projections based on Facility Plan infor-ation
SC-13	SMC MUD	1.0/2	Expand to 1.95/2 Collect - 5050	Collect - 4420	Collect - 3160	0.8/1.0	1.18/1.95	1.63/1.95	1.95/1.95	
SC-14	HC WCID 92	0.5/2	Collect - 1960	Collect - 220	Collect - 160	0.28/0.5	0.46/0.5	0.48/0.5	0.5/0.5	
	New Plant 12	-	New Plant at 0.22/2 Collect - 1200	Collect - 600	Collect - 400	0.0/0.0	0.12/0.22	0.18/0.22	0.22/0.22	
SC-15	HC MUD 82	0.15/2	Collect - 1050	Collect - 410	Expand to 0.18/2 Collect - 290	0.03/0.15	0.08/0.15	0.14/0.15	0.18/0.18	
SC-16	HC MUD 26/27	0.1/2	Collect - 510	Collect - 190	Collect - 150	0.01/0.1	0.03/0.1	0.06/0.1	0.09/0.1	
	New Plant 13	-	New plant at 0.17/2 Collect - 1340	Collect - 210	Collect - 150	0.0/0.0	0.13/0.17	0.16/0.17	0.17/0.17	
					Total Flow/Capacity	3.3/4.7	10.2/12.1	11.4/12.4	12.2/12.5	

Notes: 1) Existing Capacity/Treatment Level based on information provided by the municipal inventory (Activity 3) or Facility Plans.
2) See Table III-2 for costs.

TABLE III-2
SPRING CREEK
ESTIMATED COSTS OF WASTEWATER TREATMENT

Geographical Planning Area	Plant or Service Area	Estimated Capital Costs						Estimated Annual Operation and Maintenance Costs						Comments
		1977-1983		1984-1990		1991-1995		1977-1983		1984-1990		1991-1995		
		Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	
SC-1	New Plant 1	360,000	220,000	0	0	0	0	38,000	2,000	38,000	2,000	38,000	2,000	
	New Plant 2	360,000	66,000	0	88,000	0	66,000	38,000	500	38,000	1,000	38,000	2,000	
SC-2	New Plant 3	492,000	286,000	0	88,000	0	66,000	47,000	2,000	47,000	3,000	47,000	3,000	
SC-3	New Plant 4	900,000	1,474,000	0	66,000	0	0	71,000	10,000	71,000	11,000	71,000	11,000	
	New Plant 5	0	0	492,000	330,000	0	110,000	0	0	47,000	2,000	47,000	3,000	
	New Plant 6	0	0	0	0	360,000	220,000	0	0	0	0	38,000	2,000	
SC-4	Tomball	0	147,000	348,000	57,000	0	42,000	52,000	6,000	56,000	6,000	56,000	7,000	
	New Plant 7	456,000	308,000	0	44,000	0	22,000	45,000	2,000	45,000	2,000	45,000	3,000	
SC-5	New Plant 8	300,000	110,000	0	22,000	0	11,000	34,000	1,000	34,000	1,000	34,000	1,000	
SC-6	New Plant 9	288,000	88,000	0	11,000	0	11,000	33,000	1,000	33,000	1,000	33,000	1,000	
SC-7	Dowell	0	77,000	0	22,000	0	0	54,000	1,000	54,000	1,000	54,000	1,000	
SC-8	New Plant 10	300,000	110,000	0	22,000	0	0	34,000	1,000	34,000	1,000	34,000	1,000	
SC-9	Worchester	0	330,000	0	112,000	0	79,000	61,000	4,000	61,000	5,000	61,000	6,000	
SC-10	HC WCID 1	928,000	220,000	0	154,000	0	88,000	41,000	5,000	41,000	6,000	41,000	7,000	
SC-11	Encanto Real	0	29,000	0	26,000	0	18,000	43,000	1,000	43,000	1,000	43,000	1,000	
SC-12	HC MUD 6	4,656,000	12,100,000	0	0	0	0	482,000	90,000	482,000	90,000	482,000	90,000	
SC-13	SMC MUD	1,032,000	1,111,000	0	972,000	0	695,000	117,000	15,000	117,000	22,000	117,000	26,000	
SC-14	HC WCID 92	0	431,000	0	48,000	0	35,000	65,000	4,000	65,000	5,000	65,000	5,000	
	New Plant 12	516,000	264,000	0	132,000	0	88,000	49,000	2,000	49,000	3,000	49,000	3,000	
SC-15	HC MUD 82	0	231,000	0	90,000	240,000	64,000	43,000	2,000	43,000	3,000	46,000	3,000	
SC-16	HC MUD 26/27	0	112,000	0	42,000	0	33,000	38,000	1,000	38,000	1,000	38,000	2,000	
	New Plant 13	456,000	295,000	0	46,000	0	33,000	45,000	2,000	45,000	2,000	45,000	3,000	
	Subtotal	11,044,000	18,007,000	840,000	2,372,000	600,000	1,681,000	1,430,000	150,000	1,480,000	170,000	1,510,000	180,000	
	Total by Period	29,051,000		3,212,000		2,281,000		1,580,000		1,650,000		1,690,000		
	Amortized Capital Cost							2,400,000		2,660,000		2,850,000		
	Total Annual Cost							3,980,000		4,310,000		4,540,000		
	Cost/1000 gal							$1.62		$1.09		$1.05		

Notes: 1) See Table III-1 for construction actions required.
2) Capital costs amortized at 7½% over 30 years.
3) Costs based on 1975 dollars

Also included in the Table is an estimate for total cost per 1,000 gallons for treatment of wastewater based on the average daily dry weather flow during the time period.

TABLE III-3*

SUMMARY OF ESTIMATED COSTS
SPRING CREEK

Period	Capital Cost (Total)	O & M Cost (Annual Avg.)	Total Cost ($/1,000 Gallons)
1977 - 1983	$29,100,000	$1,580,000	1.62
1984 - 1990	3,200,000	1,650,000	1.09
1991 - 1995	2,300,000	1,690,000	1.05

* Costs based on 1975 dollars.

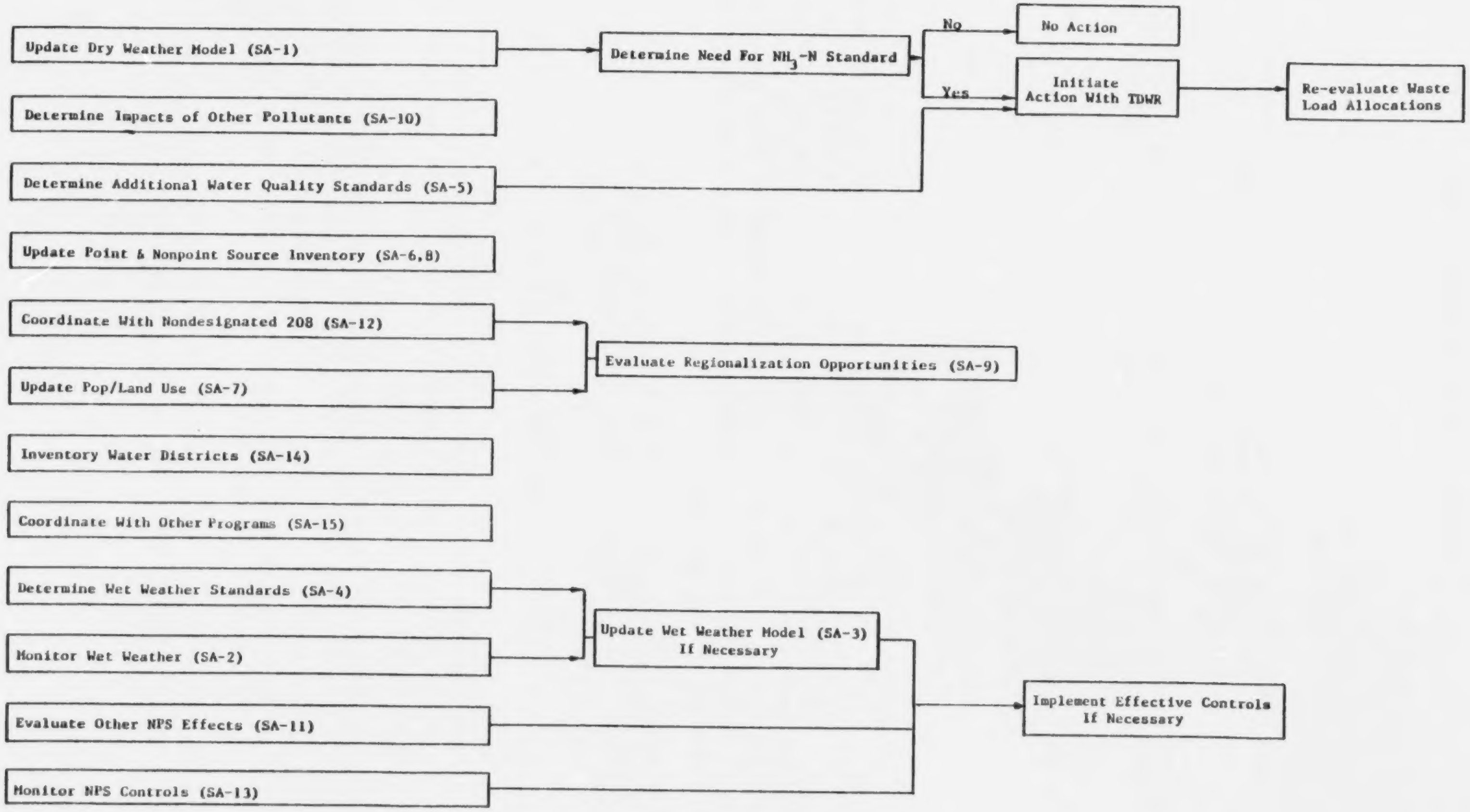
Action Check List

Items required to implement the 208 plan in the Spring Creek segment have been identified in this chapter. Figure III-1 presents the relationships between these items and other ongoing planning activities. Special activities (SA) identified in the flow chart refer to those previously described. Priorities for these special activities were presented in Chapter II.

FIGURE III-1

INTERRELATIONSHIP OF IMPLEMENTATION REQUIREMENTS

SPRING CREEK


Update Dry Weather Model (SA-1)
Determine Impacts of Other Pollutants (SA-10)
Determine Additional Water Quality Standards (SA-5)
Update Point & Nonpoint Source Inventory (SA-6,8)
Coordinate With Nondesignated 208 (SA-12)
Update Pop/Land Use (SA-7)
Inventory Water Districts (SA-14)
Coordinate With Other Programs (SA-15)
Determine Wet Weather Standards (SA-4)
Monitor Wet Weather (SA-2)
Evaluate Other NPS Effects (SA-11)
Monitor NPS Controls (SA-13)
Determine Need For NH$_3$-N Standard
No
Yes
No Action
Initiate Action With TDWR
Re-evaluate Waste Load Allocations
Evaluate Regionalization Opportunities (SA-9)
Update Wet Weather Model (SA-3) If Necessary
Implement Effective Controls If Necessary

Cypress Creek (Segment 1009)

Technical Subplan

Point Sources. The technical subplan for point source discharges includes the following:

1) Operate existing and future wastewater treatment facilities at current permit levels pending the results of the benthal load study.

2) Construct future facilities with flexibility for upgrading the level of treatment from 2N to 4NA if necessary.

3) Consider maximum limits on chlorine residual in plant effluents.

4) Actively pursue opportunities for regionalization of wastewater treatment facilities.

Nonpoint Sources. The only major nonpoint source wasteload of major concern in the Cypress Creek segment is the defined level of benthal oxygen demand on the steady-state water quality simulation model. The 208 program recommends verification and better definition of the sources, loadings, and reaction rates of benthic related wasteloads. A high priority has been assigned to this study since the results will impact on future decisions affecting major resource allocations in the segment.

Additional nonpoint source wasteloads were not calculated to be significant. The technical subplan encourages the use of best management practices to reduce the amount of nonpoint source pollutants washed to the stream.

Other. Additional recommendations for the Cypress Creek segment include:

1) Implement field studies to update and verify the dry weather model. Emphasis should be on benthal oxygen demand.

2) Implement strong enforcement policy to ensure permit compliance.

3) Implement monitoring program to verify the conclusions of the wet weather model.

4) Formulate wet weather standards consistent with fishable/swimmable water quality goal.

Impact on Regulatory Function

Permitting. The 208 program recommends that the existing level of permitted discharge to Cypress Creek be continued pending the outcome of future studies. The general level throughout the basin is effluent set 2N (BOD=10 mg/1, TSS=15 mg/1, and NH_3-N=5 mg/1).

Results of the 208 program indicate that level 2N treatment may not be sufficient to achieve fishable/swimmable water quality throughout the Creek. Additional results indicate that even at effluent set 4NA, portions of the creek may still not meet fishable/swimmable water quality due in part to the benthal oxygen demand reported for Cypress Creek. Therefore, recommendations for more restrictive permit conditions can not definitely be stated until further studies verifying modeling simulation techniques are concluded. However, the plan does recommend that new discharge permits be issued in the Cypress Creek segment with a provision for design flexibility for upgrading the level of treatment from 2N to 4NA if required by future planning efforts.

Permit requirements for maximum chlorine residuals should be considered in order to protect Cypress Creek and its aquatic environment from the possibly toxic effects of excessive chlorine and the formation of chlorinated hydrocarbons. Limiting chlorine residuals is especially important in the Cypress Creek area due to the natural state of the Creek and the fact that the Creek is tributary to Lake Houston, a major water supply for the 208 area.

Monitoring. Monitoring efforts in the Cypress Creek segment will continue to assess the segment water quality and the effluent quality through the existing mechanisms. Additional monitoring in the basin should be directed toward verification of inputs, assumptions, and conclusions developed during the technical subplanning process. Included among these items are benthic oxygen demand, population/land use, and wet weather water quality.

The 208 plan specifically recommends the implementation of a strong enforcement policy to ensure permit compliance. This will place increased demand on the existing mechanisms for monitoring of plant effluents and review of self reporting data.

Stream Standards. Dry weather standards for water quality in Cypress Creek are presently recommended to be consistent with fishable/swimmable water quality criteria for the 208 area (i.e. D.O. $\geq$ 5.0 mg/1 and fecal coliform less than 200 MPN/100 ml). However, as previously noted, it may not be possible to achieve this criteria throughout

Cypress Creek even if level 4NA treatment is implemented. Therefore, the continuing planning process will have to assess the results of future studies and determine if the existing fishable/swimmable standard is realistic and cost effective to achieve.

Wet weather water quality standards have not yet been defined for Cypress Creek. However, a special program has been defined as the basis for developing the wet weather water quality criteria, including parameters and numerical values, consistent with water uses on which the dry weather standards are based. This program is further described later in this section.

Allocations. The 208 plan recommends that the existing wasteload allocations developed by the TDWR, be continued in Cypress Creek for the present. However, the technical subplanning efforts indicate that the existing allocations combined with the defined nonpoint source wasteloads will exceed the assimilative capacity of the Creek to maintain the existing water quality standard.

Based on the results of ongoing planning efforts described elsewhere in this chapter, it appears that wasteload allocations may require redefinition by the TDWR. This stream has been classified by the TDWR as Water Quality (WQ) Limited.

Special Activities Required to Implement

A complete list of the continuing planning and special programs included as part of the 208 recommendations was presented in Chapter II. Programs specific to the Cypress Creek segment are summarized below. A complete description of the program is contained in the Appendix.

1) Update the steady-state water quality simulation model. In addition to verifying the inputs and rate constants, special emphasis should be directed toward the magnitude and sources of benthal oxygen demand. This will enable a decision to be made concerning the feasibility of meeting the existing stream standards.

2) Monitor wet weather water quality in order to verify the conclusions of the storm water simulation model.

3) Update the nonsteady-state water quality simulation model if wet weather monitoring efforts do not verify the model's conclusions.

4) Determine wet weather water quality standards. Parameters and numerical values should be consistent with fishable/swimmable water uses.

5) Determine maximum chlorine residuals which will be consistent with fishable/swimmable conditions; consider modifying permits accordingly.

6) Update the point source inventory in the segment. Emphasis should be directed toward maintaining accurate and up-to-date information that is easily updated. This will provide input to future planning efforts.

7) Update the population and land use data. Emphasis should be on computerization of data base to allow greatest flexibility of the data. Applications of this activity include re-evaluation of allocations, nonpoint source wasteload evaluation, problem area prediction, etc.

8) Update nonpoint source wasteload identification and projections. Emphasis should be directed toward dry weather contributions in the segment. Information developed should be incorporated into the existing steady-state model where applicable.

9) Evaluate regionalization opportunities in the segment. Emphasis should be on coordination of the 201 program and evaluation of planning areas during the pre-grant application phase.

10) Determine impacts of other pollutants on Cypress Creek water quality. Emphasis should be on heavy metals and toxic materials as well as suspended solids resulting from rainfall events.

11) Evaluate impacts of nonpoint source wasteloads on a basis other than the effects on water quality. Emphasis should be directed toward erosion, flood control, transportation, air quality, etc. The results will be used to interface with other environmental programs as required by 208.

12) Coordinate the nondesignated area 208 plan with the designated area 208 plan in order to efficiently implement the recommendations.

13) Monitor and analyze all existing nonpoint source controls in the Cypress Creek area. Emphasis should be on cataloguing controls and evaluating performance in order to develop a data base for a refined nonpoint source control program throughout the area.

14) Inventory and map all existing water districts and service areas in the segment. This effort will be part of the updated data base for ongoing planning.

15) Coordinate 208 plans and implementations with other environmental programs including air quality, transportation, solid waste, 201, 303, and parks/recreation projects.

Phasing and Costs

Population and land use projections were utilized as the basis for projecting the future wastewater treatment and conveyance system facility needs in the Cypress Creek segment. Table III-4 presents the phasing for three distinct time periods, for new municipal facilities, broken down by geographical planning areas. Table III-5 presents the associated cost estimates, both capital and operational and maintenance, for the projected facilities, also on a geographical planning area basis.

In Cypress Creek, the projected new facility construction for the 1977-1983 time period includes:

1) Ten new treatment plants designed for level 2N treatment with a total capacity of 1.7 MGD average daily flow.

TABLE III-4
CYPRESS CREEK
SCHEDULE OF PROJECTED CONSTRUCTION NEEDS

Geographical Planning Area	Plant Or Service Area	Existing Capacity Treatment Level	Projected Construction Needs 1977-1983	Projected Construction Needs 1984-1990	Projected Construction Needs 1991-1995	Estimated Dry Weather Flow/ Total Capacity Available (MGD) 1977	1983	1990	1995	Comments
CY-1	Waller	0.20/2	Upgrade/Expand to 0.27/2 Collect - 1550	Collect - 1360	Collect - 970	0.21/0.27	0.23/0.27	0.25/0.27	0.27/0.27	
CY-2	Sky Lakes	-	New plant at 0.08/2N Collect - 300	Collect - 300	Collect - 240	0.0/0.0	0.03/0.08	0.06/0.08	0.08/0.08	Based on the results of benthal demand studies to be completed by 1983, upgrading to 4NA may be required of all treatment plants in the segment.
CY-3	MUD 29	0.20/2	Upgrade to 2N Collect - 600	-	-	0.16/0.2	0.2/0.2	0.2/0.2	0.2/0.2	
	New Plant 1	-	New plant at 0.1/2N Collect - 300	Collect - 300	Collect - 400	0.0/0.0	0.03/0.1	0.06/0.1	0.1/0.1	
CY-4	Treeline ID	-	New plant at 0.15/2N Collect - 1500	-	-	0.14/0.15	0.15/0.15	0.15/0.15	0.15/0.15	
	Faulkey Gulley	-	New plant at 0.1/2N Collect - 800	Collect - 200	-	0.0/0.0	0.08/0.1	0.1/0.1	0.1/0.1	
	New Plant 2	-	-	New plant at 0.05/2N Collect - 200	Collect - 300	0.0/0.0	0.0/0.0	0.02/0.05	0.05/0.05	
CY-5	New Plant 3	-	New plant at 0.15/2N Collect - 1500	-	-	0.11/0.15	0.15/0.15	0.15/0.15	0.15/0.15	
	New Plant 4	-	New plant at 0.1/2N Collect - 400	Collect - 300	Collect - 300	0.0/0.0	0.04/0.1	0.07/0.1	0.1/0.1	
CY-6	WCID 113	0.15/2	Upgrade to 2N Collect - 460	Collect - 140	Collect - 100	0.11/0.15	0.12/0.15	0.14/0.15	0.15/0.15	
	Timberlake	0.30/2	Upgrade to 2N Collect - 2840	-	-	0.16/0.3	0.3/0.3	0.3/0.3	0.3/0.3	
	New Plant 5	-	New plant at 0.32/2N Collect - 1100	Collect - 1300	Collect - 800	0.0/0.0	0.11/0.32	0.24/0.32	0.32/0.32	
CY-7	Lake Forest Central	0.75/2	Upgrade to 2N Collect - 890	Collect - 780	Collect - 560	0.24/0.75	0.32/0.75	0.40/0.75	0.45/0.75	
CY-8	Charterwood	0.12/2	Upgrade to 2N Collect - 420	-	Collect - 130	0.03/0.12	0.05/0.12	0.05/0.12	0.06/0.12	
	WCID 119	0.35/2	Upgrade to 2N Collect - 1240	Collect - 220	Collect - 290	0.18/0.35	0.26/0.35	0.28/0.35	0.31/0.35	
	Kleinwood	1.0/2	Upgrade to 2N Collect - 4320	Collect - 1280	Collect - 1090	0.3/1.0	0.62/1.0	0.76/1.0	0.88/1.0	
CY-9	Tomball Rd. UD	0.30/2	Upgrade to 2N Collect - 460	Collect - 400	Collect - 280	0.21/0.3	0.25/0.3	0.29/0.3	0.3/0.3	
CY-10	Cy-Champ	0.10/2	Expand to 0.3/2N Collect - 1030	Collect - 690	Collect - 500	0.0/0.0	0.12/0.3	0.22/0.3	0.3/0.3	
	HC FWSD 52	0.36/2	Upgrade to 2N Collect - 1750	Collect - 680	Collect - 200	0.14/0.36	0.23/0.36	0.33/0.36	0.36/0.36	
	HC WCID 116	0.66/2	Upgrade to 2N Collect - 4460	Collect - 710	-	0.39/0.66	0.56/0.66	0.66/0.66	0.66/0.66	
	New Plant 6	-	-	-	New plant at 0.15 Collect - 1000	0.0/0.0	0.0/0.0	0.0/0.0	0.15/0.15	
CY-11	HC MUD 24	0.10/2	Upgrade to 2N Collect - 400	Collect - 300	Collect - 210	0.01/0.1	0.04/0.1	0.07/0.1	0.1/0.1	
	Spring Creek Forest PUD	0.05/2	Upgrade to 2N Collect - 150	-	-	0.03/0.05	0.04/0.05	0.04/0.05	0.04/0.05	
	Cypress Klein	0.05/2	Upgrade to 2N Collect - 150	-	-	0.01/0.05	0.01/0.05	0.01/0.05	0.0/0.0	
CY-12	Bammel Central	1.0/2	Upgrade to 2N Collect - 670	Collect - 590	Collect - 410	0.29/1.0	0.34/1.0	0.4/1.0	0.44/1.0	
CY-13	New Plant 7	-	New plant at 0.2/2N Collect - 1600	Collect - 200	Collect - 200	0.11/0.2	0.16/0.2	0.18/0.2	0.2/0.2	
					Total Flow/Capacity					

(Continued on following page)

Notes: 1) Existing Capacity/Treatment Level based on information provided by the municipal inventory (Activity 3) or Facility Plans.
2) See Table III-5 for costs.

TABLE III-4 (CONT'D)
CYPRESS CREEK
SCHEDULE OF PROJECTED CONSTRUCTION NEEDS

Geographical Planning Area	Plant Or Service Area	Existing Capacity Treatment Level	Projected Construction Needs			Estimated Dry Weather Flow/ Total Capacity Available (MGD)				Comments
			1977-1983	1984-1990	1991-1995	1977	1983	1990	1995	
CY-13 (Continued)	New Plant 8	-	-	-	New plant at 0.15/2N Collect - 1600	0.0/0.0	0.0/0.0	0.0/0.0	0.15/0.15	
CY-14	Ponderosa Forest	0.40/2	Upgrade to 2N Collect - 740	Collect - 300	Collect - 200	0.37/0.4	0.4/0.4	0.4/0.4	0.4/0.4	
	Ponderosa Central	1.4/2	Upgrade to 2N Collect - 3210	Collect - 1250	Collect - 900	0.8/1.4	1.02/1.4	1.24/1.4	1.4/1.4	
	CNP UD	0.10/2	Upgrade/Expand to 0.55/2N Collect - 4420	Collect - 1470	-	0.12/0.1	0.35/0.55	0.55/0.55	0.55/0.55	
	New Plant 9	-	-	New plant at 0.2/2N Collect - 1440	-	0.0/0.0	0.0/0.0	0.0/0.0	0.2/0.2	
CY-15	Dove Meadow	0.14/2	Upgrade to 2N Collect - 400	Collect - 150	Collect - 100	0.04/0.14	0.05/0.14	0.08/0.14	0.12/0.14	
	Candlelight Hills	0.13/2	Upgrade to 2N Collect - 700	Collect - 270	Collect - 200	0.04/0.13	0.07/0.13	0.11/0.13	0.13/0.13	
	WCID 110	0.30/2	Upgrade to 2N Collect - 520	Collect - 200	Collect - 150	0.25/0.3	0.27/0.3	0.29/0.3	0.3/0.3	
	New Plant 10	-	New plant at 0.25/2N Collect - 2500	-	-	-	0.25/0.25	0.25/0.25	0.25/0.25	
	New Plant 11	-	New plant at 0.25/2N Collect - 2500	-	-	-	0.25/0.25	0.25/0.25	0.25/0.25	
	New Plant 12	-	-	New plant at 0.2/2N Collect - 1400	Collect - 600	-	-	0.14/0.20	0.2/0.2	
CY-16	WCID 99	0.30/2	Upgrade to 2N Collect - 1270	Collect - 950	Collect - 100	0.09/0.3	0.16/0.3	0.22/0.3	0.22/0.3	
	Timberlane UD	0.22/2	Upgrade to 2N Collect - 760	Collect - 60	Collect - 50	0.15/0.22	0.20/0.22	0.21/0.22	0.22/0.22	
	New Plant 13	-	-	-	New plant at 0.05/2N Collect - 500	0.0/0.0	0.0/0.0	0.0/0.0	0.05/0.05	
CY-17	Inverness Forest	0.20/2	Upgrade to 2N Collect - 290	Collect - 100	Collect - 100	0.17/0.2	0.18/0.2	0.19/0.2	0.2/0.2	
	Memorial Hills	0.21/2	Upgrade to 2N Collect - 1300	-	-	0.12/0.21	0.20/0.21	0.21/0.21	0.21/0.21	
	New Plant 14	-	-	-	New plant at 0.05/2N Collect - 500	0.0/0.0	0.0/0.0	0.0/0.0	0.05/0.05	
CY-18	Treschwig Central (WCID 136)	1.0/2	Upgrade to 2N Collect - 1650	Collect - 650	Collect - 550	0.21/1.0	0.32/1.0	0.39/1.0	0.44/1.0	
					Total Flow/Capacity	5.2/10.6	7.9/12.5	10.0/12.8	11.6/13.3	

Notes: 1) Existing Capacity/Treatment Level based on information provided by the municipal inventory (Activity 3) or Facility Plans.
2) See Table III-5 for costs.

TABLE III-5
CYPRESS CREEK
ESTIMATED COSTS OF WASTEWATER TREATMENT

Geographical Planning Area	Plant or Service Area	Estimated Capital Costs						Estimated Annual Operation and Maintenance Costs						Comments
		1977-1983		1984-1990		1991-1995		1977-1983		1984-1990		1991-1995		
		Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	
CY-1	Waller	888,000	341,000	0	299,000	0	213,000	73,000	4,000	73,000	6,000	73,000	8,000	
CY-2	Sky Lakes	588,000	66,000	0	66,000	0	53,000	49,000	500	49,000	1,000	49,000	1,000	
CY-3	MUD 29	312,000	132,000	0	0	0	0	66,000	3,000	66,000	3,000	66,000	3,000	
	New Plant 1	624,000	66,000	0	66,000	0	88,000	52,000	1,000	52,000	1,000	52,000	2,000	
CY-4	Treeline 10	720,000	330,000	0	0	0	0	59,000	2,000	59,000	2,000	59,000	2,000	
	Faulkey Gulley	624,000	176,000	0	44,000	0	0	52,000	1,000	52,000	1,000	52,000	1,000	
	New Plant 2	0	0	528,000	44,000	0	66,000	0	0	42,000	1,000	42,000	1,000	
CY-5	New Plant 3	720,000	330,000	0	0	0	0	59,000	2,000	59,000	2,000	59,000	2,000	
	New Plant 4	624,000	88,000	0	66,000	0	66,000	52,000	1,000	52,000	1,000	52,000	2,000	
CY-6	WCID 113	288,000	101,000	0	31,000	0	22,000	59,000	1,000	59,000	2,000	59,000	2,000	
	Timberlake	336,000	625,000	0	0	0	0	75,000	6,000	75,000	6,000	75,000	6,000	
	New Plant 5	966,000	242,000	0	286,000	0	176,000	78,000	2,000	78,000	4,000	78,000	5,000	
CY-7	Lake Forest Cen.	384,000	196,000	0	172,000	0	123,000	103,000	8,000	103,000	9,000	103,000	10,000	
CY-8	Charterwood	270,000	92,000	0	0	0	29,000	55,000	1,000	55,000	1,000	55,000	1,000	
	WCID 119	348,000	273,000	0	48,000	0	64,000	80,000	3,000	80,000	4,000	80,000	4,000	
	Kleinwood	396,000	950,000	0	282,000	0	240,000	115,000	8,000	115,000	10,000	115,000	12,000	
CY-9	Tomball UD	336,000	101,000	0	88,000	0	62,000	75,000	3,000	75,000	3,000	75,000	4,000	
CY-10	Cy-Champ	1,068,000	403,000	0	152,000	0	110,000	75,000	3,000	75,000	4,000	75,000	5,000	
	HC FWSD 52	348,000	385,000	0	150,000	0	44,000	80,000	6,000	80,000	7,000	80,000	7,000	
	HC WCID 116	384,000	981,000	0	156,000	0	0	99,000	9,000	99,000	10,000	99,000	10,000	
	New Plant 6	0	0	0	0	720,000	220,000	0	0	0	0	59,000	2,000	
CY-11	HC MUD 24	264,000	88,000	0	66,000	0	46,000	52,000	1,000	52,000	1,000	52,000	1,000	
	Spring Creek Forest PUD	240,000	33,000	0	0	0	0	42,000	1,000	42,000	1,000	42,000	1,000	
	Cypress Klein	240,000	33,000	0	0	0	0	42,000	1,000	42,000	1,000	42,000	1,000	
CY-12	Bammel Central	396,000	147,000	0	130,000	0	90,000	115,000	3,000	115,000	4,000	115,000	5,000	
CY-13	New Plant 7	804,000	352,000	0	44,000	0	44,000	66,000	2,000	66,000	3,000	66,000	3,000	
	New Plant 8	0	0	0	0	720,000	352,000	0	0	0	0	59,000	2,000	
CY-14	Ponderosa Forest	360,000	163,000	0	66,000	0	44,000	83,000	5,000	83,000	5,000	83,000	5,000	
	Ponderosa Central	480,000	708,000	0	275,000	0	198,000	138,000	12,000	138,000	14,000	138,000	15,000	
	CNP UD	1,356,000	972,000	0	323,000	0	0	92,000	8,000	92,000	10,000	92,000	10,000	
	New Plant 9	0	0	804,000	317,000	0	0	0	0	66,000	2,000	66,000	2,000	
CY-15	Dove Meadows	288,000	88,000	0	33,000	0	22,000	58,000	4,000	58,000	4,000	58,000	4,000	
	Candlelight Hills	288,000	154,000	0	48,000	0	44,000	57,000	2,000	57,000	3,000	57,000	3,000	
	WCID 110	336,000	114,000	0	44,000	0	33,000	75,000	3,000	75,000	3,000	75,000	3,000	
	New Plant 10	876,000	550,000	0	0	0	0	71,000	4,000	71,000	4,000	71,000	4,000	
	New Plant 11	876,000	550,000	0	0	0	0	71,000	4,000	71,000	4,000	71,000	4,000	
	New Plant 12	0	0	804,000	308,000	0	132,000	0	0	66,000	2,000	66,000	3,000	

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Notes: 1) See Table III-4 for construction actions required.
2) Capital costs amortized at 7¼% over 30 years.
3) Costs based on 1975 dollars.

TABLE III-5 (CONT'D)
CYPRESS CREEK
ESTIMATED COSTS OF WASTEWATER TREATMENT

Geographical Planning Area	Plant or Service Area	Estimated Capital Costs						Estimated Annual Operation and Maintenance Costs						Comments
		1977-1983		1984-1990		1991-1995		1977-1983		1984-1990		1991-1995		
		Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	
CY-16	WC19 99	336,000	279,000	0	209,000	0	22,000	75,000	5,000	75,000	6,000	75,000	6,000	
	Timberlane UD	324,000	167,000	0	13,000	0	11,000	68,000	3,000	68,000	3,000	68,000	3,000	
	New Plant 13	0	0	0	0	528,000	110,000	0	0	0	0	42,000	1,000	
CY-17	Inverness Forest	312,000	64,000	0	22,000	0	22,000	66,000	3,000	66,000	3,000	66,000	4,000	
	Memorial Hills	324,000	286,000	0	0	0	0	67,000	2,000	67,000	2,000	67,000	2,000	
	New Plant 14	0	0	0	0	528,000	110,000	0	0	0	0	42,000	1,000	
CY-18	Treschwig Central	396,000	363,000	0	143,000	0	121,000	115,000	5,000	115,000	6,000	115,000	7,000	
	Subtotal	18,720,000	10,990,000	2,136,000	3,990,000	2,500,000	2,980,000	2,709,000	132,000	2,883,000	159,000	3,085,000	180,000	
	Total by Period	29,709,000		6,127,000		5,473,000		2,841,000		3,042,000		3,265,000		
	Amortized Capital Cost							2,454,000		2,960,000		3,412,000		
	Total Annual Cost							5,296,000		6,002,000		6,677,000		
	Cost/1000 gal							$2.22		$1,84		$1.69		

Notes: 1) See Table III-4 for construction actions required.
2) Capital costs amortized at 7⅛% over 30 years.
3) Costs based on 1975 dollars.

2) Upgrading twenty-three existing plants from level 2 treatment, to level 2N treatment.

3) Upgrade and expand three existing treatment plants from level 2 treatment to level 2N, increasing total capacity by an additional 0.72 MGD.

4) New collection systems serving an additional 49,950 persons.

Facilities projected for the 1984-1990 time period include:

1) Three new plants operating at effluent set 2N with a a total design capacity of 0.45 MGD.

2) New collection systems serving an additional 18,190 persons.

It should be noted that the ongoing planning studies identified for Cypress Creek may result in alternate allocations for the segment requiring as high as level 4NA treatment if found to be necessary. Upgrading to level 4NA would be implemented during the 1984-1990 time frame.

Facilities projected for the final time period, 1991-1995, include:

1) Four new treatment plants designed to operate at effluent set 2N, with a total capacity of 0.40 MGD.

2) New collection systems designed to accommodate an additional 13,430 persons.

The associated estimated costs for capital expenses and annual operational and maintenance expenses are summarized in Table III-6. Also included in the Table is an estimate for the total cost per 1000 gallons for treatment of wastewater based on average daily dry weather flow during the time period.

TABLE III-6

SUMMARY OF ESTIMATED COSTS*
CYPRESS CREEK

Period	Capital Cost (Total)	O & M Cost (Annual Avg.)	Total Cost ($/1,000 Gallons)
1977 - 1983	$29,700,000	$2,840,000	2.22
1984 - 1990	6,100,000	3,040,000	1.84
1991 - 1995	5,500,000	3,270,000	1.69

* Costs based on 1975 dollars.

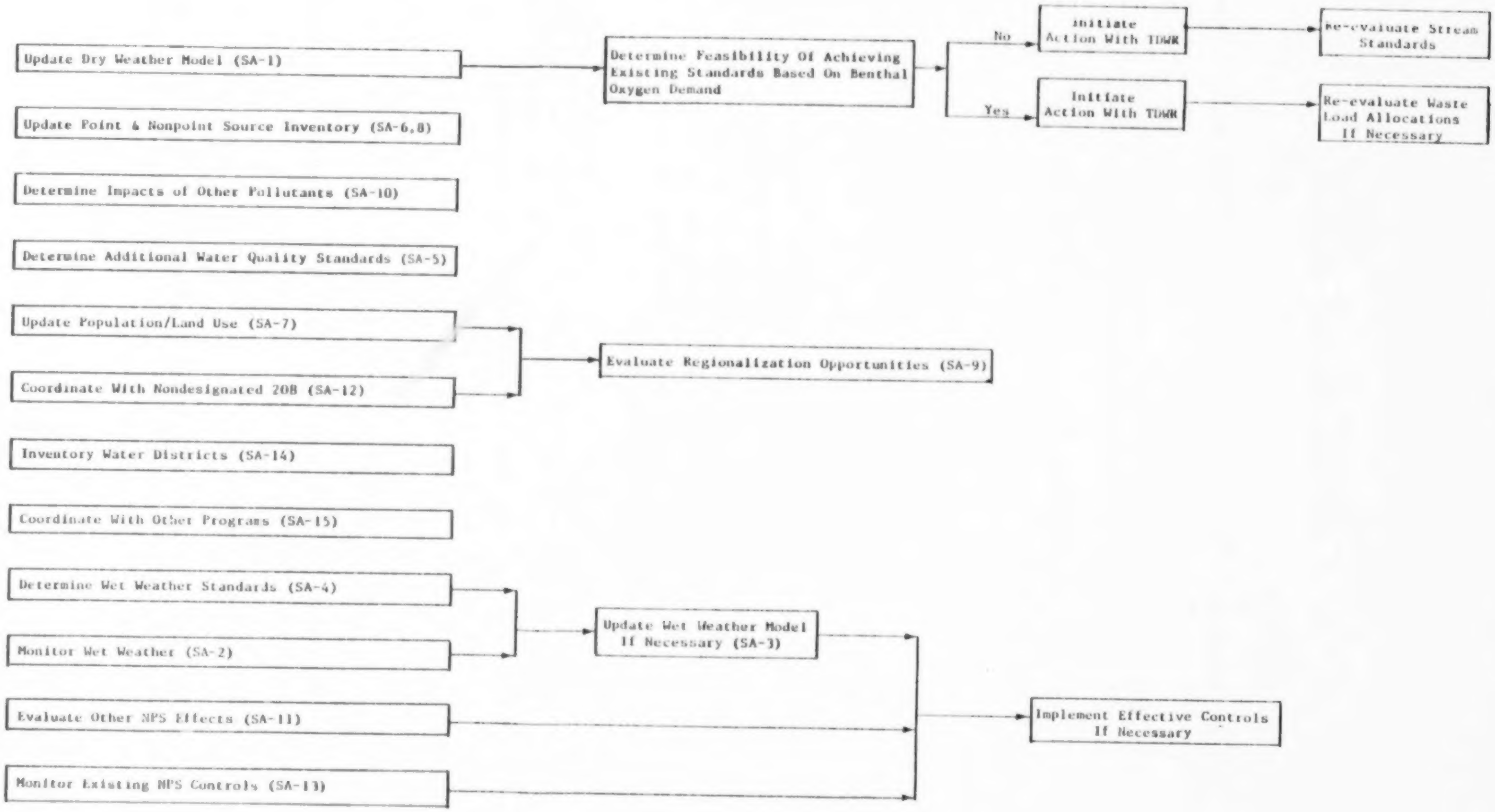
Action Check List

Items required to implement the 208 plan in the Cypress Creek segment have been identified in this chapter. Figure III-2 presents the interrelationships between activities, decisions, and ongoing planning efforts. Special activities (SA) identified in the figure refer to those previously described in the Cypress Creek section. Priorities and further definition for the special activities was presented in Chapter II.

FIGURE III-2

INTERRELATIONSHIP OF IMPLEMENTATION REQUIREMENTS

CYPRESS CREEK


Update Dry Weather Model (SA-1)
Update Point & Nonpoint Source Inventory (SA-6,8)
Determine Impacts of Other Pollutants (SA-10)
Determine Additional Water Quality Standards (SA-5)
Update Population/Land Use (SA-7)
Coordinate With Nondesignated 208 (SA-12)
Inventory Water Districts (SA-14)
Coordinate With Other Programs (SA-15)
Determine Wet Weather Standards (SA-4)
Monitor Wet Weather (SA-2)
Evaluate Other NPS Effects (SA-11)
Monitor Existing NPS Controls (SA-13)
Determine Feasibility Of Achieving Existing Standards Based On Benthal Oxygen Demand
No
Yes
Initiate Action With TDWR
Initiate Action With TDWR
Re-evaluate Stream Standards
Re-evaluate Waste Load Allocations If Necessary
Evaluate Regionalization Opportunities (SA-9)
Update Wet Weather Model If Necessary (SA-3)
Implement Effective Controls If Necessary

Lake Houston (Segment 1002)

Technical Subplan

Point Sources. The technical subplan for point source discharges includes the following:

1) Operate existing and future wastewater treatment facilities at the existing permit levels.

2) Consider maximum limits on chlorine residual in plant effluents.

3) Study the relationship of point source wasteloads to eutrophication in Lake Houston.

4) Keep alert to regional wastewater treatment opportunities if warranted by future population patterns and economic justifications.

Nonpoint Sources. Nonpoint source wasteloads were not projected to be a major concern relative to the fishable/swimmable parameters of D.O. and fecal coliform. However, nonpoint sources were identified as major contributors to the total phosphorus loading into Lake Houston. Additionally, nonpoint source phosphorus loadings from outside the 208 planning area were estimated based on other available information and found to be significant.

The 208 technical subplan recommends that best management practices be encouraged to reduce the amount of nonpoint source pollutants washed into Lake Houston. Additionally, a eutrophication study to encompass the entire Lake Houston watershed is recommended.

Other. Additional recommendations include:

1) Formulate wet weather water quality standards consistent with fishable/swimmable criteria.

2) Implement field monitoring to verify conclusions of wet weather and dry weather water quality.

Impact On Regulatory Function

Permitting. The 208 program recommends that the existing level of permitted discharge in the Lake Houston drainage area be continued. The general level throughout the segment is effluent set 2N (BOD=10 mg/1, TSS=15 mg/1, and NH_3-N=5 mg/1) except for the Kingwood plant (HC UD 5) which is permitted at effluent set 3N (BOD=5 mg/1, TSS=10 mg/1, and NH_3-N=5 mg/1).

One possible impact on permitting due to the 208 plan is the recommendation that maximum chlorine residual levels be considered in order to protect Lake Houston and its aquatic environment from the possibly toxic effects of excessive chlorine and the formation of chlorinated hydrocarbons. Although there is considerable dilution available in the Lake, it is not a completely mixed system, and pockets of high concentration could occur. Additionally, the Lake serves as the major drinking water reservoir in the planning area and should be protected.

A major impact may result on existing and future permitting in the entire Lake Houston drainage basin (Spring Creek, Cypress Creek, Upper San Jacinto, etc.) based on the results of future studies recommended in the 208 plan. Results of the technical work indicate that excessive levels of phosphorus are entering Lake Houston and that there is a high potential for eutrophication.

A priority consistent with ongoing planning has been assigned to the eutrophication study in Lake Houston. If results indicate that eutrophication can be controlled through a point source and nonpoint source control program, future permitting efforts will need to reflect these control recommendations.

Monitoring. Monitoring efforts in Lake Houston will continue to assess the segment water quality and the effluent water quality through the existing mechanisms. Additional monitoring in Lake Houston should be directed toward verification of input data and recommended studies. Included among these items are: population/land use, wet weather water quality, phosphorus loading evaluation, etc.

Stream Standards. Dry weather standards for Lake Houston water quality are recommended to be consistent with fishable/swimmable and water supply quality criteria within the 208 planning area (i.e. D.O. $\geq$ 5.0 mg/1 and fecal coliform less than 20 MPN/100 ml).

Wet weather water quality standards have not yet been defined for Lake Houston. However, a special program has been defined as the basis for developing the wet weather water quality criteria, including parameters and numerical values consistent with water uses on which the dry weather standards are based. This program is detailed elsewhere in this report.

Allocations. The 208 plan recommends that the existing wasteload allocations developed by the TDWR be continued in Lake Houston. This recommendation is based on uncalibrated and unverified modeling techniques and baseline data. Ongoing planning recommendations include updating the data base and monitoring to verify the modeling conclusions. Lake Houston has been classified by the TDWR as Water Quality (WQ) Limited.

Special Activities Required to Implement

A complete list of the continuing planning and special programs as part of the 208 recommendations was presented in Chapter II. Programs pertaining to Lake Houston are summarized below. A complete description of the program is contained in the Appendix.

1) Conduct eutrophication study. Emphasis should be on total phosphorus entering the Lake and available controls. Results should be utilized to verify plan recommendations.

2) Monitor wet weather water quality in order to verify assumptions and initiate data base.

3) Determine wet weather water quality standards. Parameters and numerical values should be consistent with fishable/swimmable and water supply uses.

4) Determine maximum chlorine residuals which will be consistent with fishable/swimmable conditions; consider modifying permits accordingly.

5) Update the point source inventory. Emphasis should be directed toward maintaining accurate and up-to-date information that is easily updated. This will provide input to future planning efforts.

6) Update the population and land use data. This needs particular attention in the Lake Houston area. Emphasis should be on computerization of data base to allow greatest flexibility of the data. Applications of this activity include re-evaluation of allocations, nonpoint source wasteload evaluation, problem area prediction, etc.

7) Update nonpoint source wasteload identification and projections. Emphasis should be directed toward dry weather contributions in the basin. Information developed should be incorporated into the existing data base.

8) Evaluate regionalization opportunities. Emphasis should be on coordination of the 201 program and evaluation of planning areas during the pre-grant application phase.

9) Determine impacts of other pollutants on Lake Houston water quality. Emphasis should be on heavy metals and toxic materials as well as suspended solids.

10) Evaluate impacts of nonpoint source wasteloads on a basis other than the effects on water quality. Emphasis should be directed toward erosion, flood control, transportation, air quality, etc. The results will be used to interface with other environmental programs as required by 208.

11) Coordinate the nondesignated area 208 plan with the designated area 208 plan in order to efficiently implement the recommendations.

12) Monitor and analyze all existing nonpoint source controls in the Lake Houston area. Emphasis should be on cataloguing controls and evaluating performance in order to develop data base for a refined nonpoint source control program throughout the area.

13) Inventory and map all existing water districts and service areas in the segment. This effort will be part of the updated data base for ongoing planning.

14) Coordinate 208 plans and implementations with other environmental programs including air quality, transportation, solid waste, 201, 303, and parks/recreation projects.

Phasing and Costs

Population and land use projections were utilized as the basis for projecting the future wastewater treatment and conveyance system facility needs in the Lake Houston area. Table III-7 presents the phasing for three distinct time periods, for new municipal facilities broken down by geographical planning areas. Table III-8 presents the associated cost estimates, both capital and operational and maintenance, for the projected facilities, also on a geographical planning area basis.

In Lake Houston, the projected new facility construction for the 1977-1983 time period includes:

1) One new treatment plant with a projected flow of 0.25 MGD.

2) One plant expansion invloving two existing facilities, increasing total capacity by 2.0 MGD.

3) New collection systems serving an additional 13,250 persons.

Facilities projected for the 1984-1990 time period include:

1) Two plant expansions increasing capacity by a total of 0.42 MGD.

2) Additional collection systems serving another 5,190 persons.

Facilities projected for the final period, 1991-1995 include collection systems for 4,560 additional persons.

The associated estimated costs for capital expenses and annual operational and maintenance expenses are summarized in Table III-9. Also included in the Table is an estimate for the total cost per 1000 gallons for treatment of wastewater based on average daily dry weather flow during the time period.

TABLE III-7
LAKE HOUSTON
SCHEDULE OF PROJECTED CONSTRUCTION NEEDS

Geographical Planning Area	Plant Or Service Area	Existing Capacity Treatment Level	Projected Construction Needs			Estimated Dry Weather Flow/ Total Capacity Available (MGD)				Comment
			1977-1983	1984-1990	1991-1995	1977	1983	1990	1995	
LH-1	Humble (South Dennis)	0.5/2	Upgrade to 2N Collect - 1370	Expand to 0.67/2N Collect - 1200	Collect - 860	0.28/0.5	0.44/0.5	0.57/0.67	0.67/0.67	
LH-2	HC FWSD 60	-	New plant at 0.25/2N Collect - 950	Collect - 85	Collect - 500	0.0/0.0	0.1/0.25	0.18/0.25	0.24/0.25	
	Forest Cove	0.5/2	Upgrade to 2N Collect - 1930	Expand to 0.75/2N Collect - 1700	Collect - 1200	0.27/0.5	0.44/0.5	0.61/0.75	0.73/0.75	
	HC UD 5	0.5/2				0.48/0.5				
	HC UD 5	0.5/2	New plant at 3.0/3N Collect - 9000	Collect - 2200	Collect - 2000	0.43/0.5	1.6/3.0	1.8/3.0	2.0/3.0	Proposed expansion based on information in Wasteload Evaluation Report. Phase II and III expansions to 6.0 mgd and 9.0 mgd are proposed in other planning efforts.
					Total Flow/Capacity	1.5/2.0	2.6/4.3	3.2/4.7	3.6/4.7	

Notes: 1) Existing Capacity/Treatment Level based on information provided by the municipal inventory (Activity 3) or Facility Plans.
2) See Table III-8 for costs.

TABLE III-8
LAKE HOUSTON
ESTIMATED COSTS OF WASTEWATER TREATMENT

Geographical Planning Area	Plant or Service Area	Estimated Capital Costs						Estimated Annual Operation and Maintenance Costs						Comments
		1977-1983		1984-1990		1991-1995		1977-1983		1984-1990		1991-1995		
		Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	
LH-1	Humble (South Dennis)	368,000	301,000	768,000	264,000	0	189,000	89,000	10,000	99,000	12,000	99,000	13,000	
LH-2	HC FWSD 60	876,000	209,000	0	19,000	0	110,000	71,000	1,000	71,000	2,000	71,000	2,000	
	Forest Cove	368,000	425,000	876,000	374,000	0	264,000	89,000	6,000	103,000	9,000	103,000	11,000	
	HC UD 5 (1105901) HC UD 5 (1135901)	3,480,000	1,980,000	0	484,000	0	440,000	235,000	24,000	235,000	27,000	235,000	30,000	
	Subtotal	5,092,000	2,915,000	1,644,000	1,141,000	0	1,003,000	484,000	41,000	508,000	50,000	508,000	56,000	
	Total by Period	8,007,000		2,785,000		1,003,000		525,000		558,000		564,000		
	Amortized Capital Cost							661,000		891,000		974,000		
	Total Annual Cost							1,186,000		1,449,000		1,538,000		
	Cost/1000 gal							$1.59		$1.37		$1.24		

Notes: 1) See Table III-7 for construction actions required
2) Capital costs amortized at 7¼% over 30 years.
sts based on 1975 dollars.

TABLE III-9

SUMMARY OF ESTIMATED COSTS*
LAKE HOUSTON

Period	Capital Cost (Total)	O & M Cost (Annual Avg.)	Total Cost ($/1,000 Gallons)
1977 - 1983	8,000,000	525,000	1.59
1984 - 1990	2,790,000	558,000	1.37
1991 - 1995	1,000,000	564,000	1.24

* Costs based on 1975 dollars.

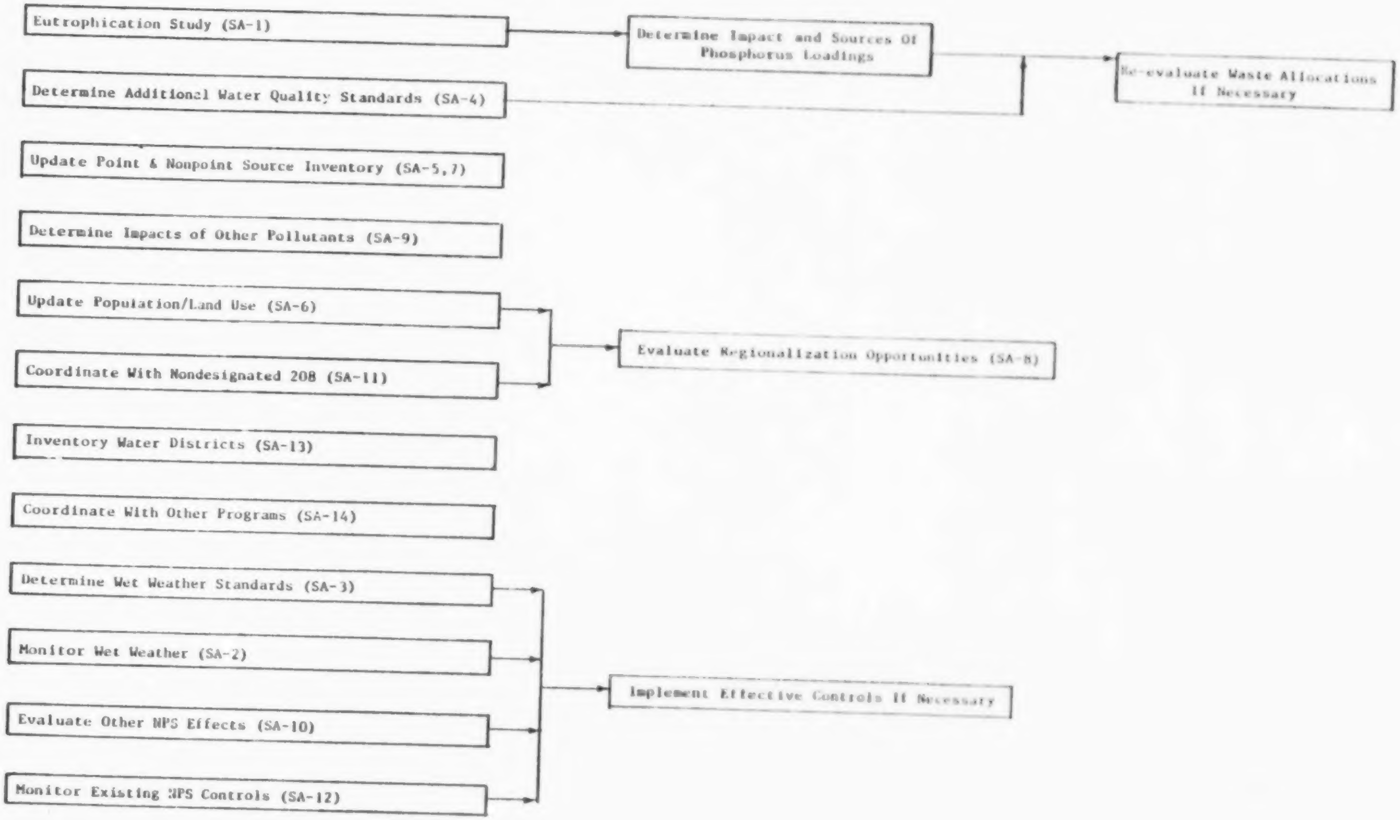
Action Check List

Items required to implement the 208 plan for Lake Houston have been identified in this chapter. Figure III-3 presents the relationships between these items and other ongoing planning activities. Special activities (SA) identified in the flow chart refer to those previously described. Priorities for these special activities were presented in Chapter II.

FIGURE III-3

INTERRELATIONSHIP OF IMPLEMENTATION REQUIREMENTS

LAKE HOUSTON


Eutrophication Study (SA-1)
Determine Impact and Sources Of Phosphorus Loadings
Re-evaluate Waste Allocations If Necessary
Determine Additional Water Quality Standards (SA-4)
Update Point & Nonpoint Source Inventory (SA-5,7)
Determine Impacts of Other Pollutants (SA-9)
Update Population/Land Use (SA-6)
Coordinate With Nondesignated 208 (SA-11)
Evaluate Regionalization Opportunities (SA-8)
Inventory Water Districts (SA-13)
Coordinate With Other Programs (SA-14)
Determine Wet Weather Standards (SA-3)
Monitor Wet Weather (SA-2)
Evaluate Other NPS Effects (SA-10)
Monitor Existing NPS Controls (SA-12)
Implement Effective Controls If Necessary

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CHAPTER IV CLEAR LAKE SUBBASIN

CHAPTER IV - CLEAR LAKE SUBBASIN

Clear Creek - Nontidal (Segment 1102)

Technical Subplan

Point Sources. The technical subplan for point source discharges includes the following:

1) Operate existing and future wastewater treatment facilities at current permit levels pending the results of recommended studies.

2) Consider elimination of the phosphorus requirement based on the result of the recommended Clear Lake eutrophication study.

3) Evaluate interbasin transport of treated effluent as an economic alternative to upgrading.

4) Consider maximum limits on chlorine residual in plant effluents.

Nonpoint Sources. The technical subplan for nonpoint source wasteloads includes implementation of the following items:

1) Select and develop test areas to monitor the effectiveness of nonstructural controls as detailed in the special studies section.

2) Pending the outcome of model verification and test area work, reserve sufficient land to implement nonstructural controls as area develops.

3) Encourage best management practices to reduce the amount of pollutants to the stream.

Other. Additional recommendations for the Clear Creek nontidal segment include:

1) Implement field studies to update and verify the dry weather model. Emphasis should be on basic parameters such as rate constants, etc.

2) Implement monitoring program to verify the conclusions of the wet weather model and to establish a data base for future verification.

3) Formulate wet weather standards consistent with fishable/swimmable water quality uses.

4) Implement strong enforcement policy to ensure permit compliance.

Impact on Regulatory Function

Permitting. The 208 program recommends that the existing level of permitted discharge to Clear Creek nontidal be continued pending the outcome of future studies. The general level throughout the subbasin is modified effluent set 3NP (BOD=5 mg/l, TSS=12 mg/l, NH_3-N=5 mg/l, and P=2 mg/l).

Results of the 208 program indicate that level 3NP treatment may not be sufficient to achieve fishable/swimmable water quality throughout the Creek. Additional results indicate that even at effluent set 4NPA, portions of the creek may still not meet fishable/swimmable water quality.

Two alternatives have been selected for further consideration in upgrading the segment water quality. One involves upgrading the level of wastewater treatment in the segment to effluent set 4NPA. The other involves interbasin transport of treated effluent (level 2) from a certain area to the Houston Ship Channel with the remaining plants operating at 4NPA.

If further efforts verify the predictions of the water quality simulation model, and if either of the two alternatives are implemented, new discharge permits will be required in the basin.

Permit requirements for maximum chlorine residuals should be considered in order to protect Clear Creek nontidal and its aquatic environment from the possibly toxic effects of excessive chlorine and the formation of chlorinated hydrocarbons. Limiting chlorine residuals is important in the subbasin due to the natural state of the Creek.

Additional impacts on permitting will occur if the results of the proposed eutrophication study on Clear Lake indicate that the phosphorus requirement in the Greater Clear Lake drainage basin is not cost effective.

Monitoring. Monitoring efforts in The Clear Creek nontidal segment will continue to assess the segment water quality and the effluent quality through the existing mechanisms. Additional monitoring in the area will be required to implement the technical subplan. These additional monitoring requirements should emphasize the following:

1) Verification of inputs, assumptions and conclusions developed during the technical subplanning process.

2) Identification of major areas contributing to non-point source wasteloads.

3) Effectiveness of the nonstructural controls implemented in the selected test areas.

4) Careful review of monitored data to ensure a strong enforcement policy for permit compliance.

These additional monitoring requirements should be performed through existing mechanisms. Coordination of nonpoint source monitoring to develop a data base concerning the effectiveness of non-structural controls can be provided through H-GAC and the WQC.

Stream Standards. Dry weather standards for water quality in the nontidal segment of Clear Creek are presently recommended to be consistent with fishable/swimmable water quality criteria for the 208 area (i.e., D.O. $\geq$ 5.0 mg/l and fecal coliform less than 200 MPN/100 ml). However, as previously noted, it may not be possible to achieve the D.O. criteria throughout the segment even if level 4NPA treatment is implemented. Therefore, the continuing planning process must address the results of future studies and determine if the existing fishable/swimmable standard is realistic and cost effective to achieve. The TDWR may have to determine alternative dry weather water quality standards for Clear Creek nontidal if the existing standards cannot be achieved.

Wet weather water quality standards have not yet been defined for the area. Since nonpoint source control strategies are being recommended for this area, it is important that standards concerning wet weather water quality be defined. The TDWR should set parameters and numerical values consistent with water quality uses on which dry weather standards are based. A special program for the development of wet weather water quality standards has been defined in Chapter II.

Allocations. The 208 plan recommendations include presently maintaining the existing wasteload allocations in Clear Creek nontidal. However, technical subplanning efforts indicate that based on future loadings, the existing allocations combined with the defined nonpoint source wasteloads may exceed the assimilative capacity of the Creek.

Based on the results of ongoing planning efforts described elsewhere in this chapter, it appears that wasteload allocations may require redefinition by the TDWR. This stream has been classified by the TDWR as Water Quality (WQ) Limited.

Special Activities Required to Implement

A complete list of the continuing planning and special programs included as part of the 208 recommendations was presented in Chapter II. Programs specific to the nontidal segment of Clear Creek are summarized below. A complete description of the program is contained in the Appendix.

1) Update the steady-state water quality simulation model. Emphasis should be directed at verifying the inputs and rate constants.

2) Monitor the wet weather water quality. Emphasis should be on model verification and development of a data base.

3) Update the nonsteady-state water quality simulation model if wet weather monitoring verifies the model's conclusions.

4) The TDWR should initiate eutrophication study in the Clear Lake drainage basin. Emphasis should be on total phosphorus loading and sources. Results will be utilized in determining the cost effectiveness of existing point source phosphorus controls.

5) Evaluate interbasin transport alternative. Emphasis should be directed toward determining cost effectiveness, acceptability and environmental impact.

6) Determine wet weather water quality standards. Parameters and numerical values should be consistent with dry weather water uses.

7) Determine maximum chlorine residuals which will be consistent with fishable/swimmable conditions; consider modifying permits accordingly.

8) Update the point source inventory in the basin. Emphasis should be directed toward maintaining accurate and up-to-date information that is easily updated. This will provide input to future planning efforts.

9) Update the population and land use data. Emphasis should be on computerization of data base to allow greatest flexibility of the data. Applications of this activity include re-evaluation of allocations, nonpoint source wasteload evaluation, problem area prediction, etc.

10) Update nonpoint source wasteload identification and projections. Emphasis should be directed toward verifying wet weather conditions as well as determining dry weather contributions in the basin. Information developed should be incorporated into the existing steady-state and nonsteady-state models where applicable.

11) Evaluate regionalization opportunities. Emphasis should be on coordination of the 201 program and evaluation of planning areas during the pre-grant application phase.

12) Determine impacts of other pollutants on Clear Creek water quality. Emphasis should be on heavy metals and toxic materials as well as suspended solids.

13) Evaluate impacts of nonpoint source wasteloads on a basis other than the effects on water quality. Emphasis should be directed toward erosion, flood control, transportation, air quality, etc. The results will be used to interface with other environmental programs as required by 208.

14) Coordinate the nondesignated area 208 plan with the designated area 208 plan in order to efficiently implement the recommendations.

15) Monitor and analyze all existing nonpoint source controls in the Clear Creek area. Emphasis should be on cataloguing controls and evaluating performance in order to develop a data base for a refined nonpoint source control program throughout the area.

16) Inventory and map all existing water districts and service areas in the basin. This effort will be part of the updated data base for ongoing planning.

17) Coordinate 208 plans and implementations with other environmental programs including air quality, transportation, solid waste, 201, 203, coastal management and parks/recreation projects.

Phasing and Costs

Population and land use projections along with existing 201 plans, were utilized as the basis for projecting the future wastewater treatment and conveyance system facility needs in the nontidal segment of Clear Creek. Table IV-1 presents the phasing for three distinct time periods, for new municipal facilities broken down by geographical planning areas. (A description and maps of the geographical planning areas are contained in the Alternative Technical Subplans report). Table IV-2 presents the associated cost estimates, both capital and operational and maintenance, for the projected facilities also on a geographical planning area basis.

In the nontidal segment of Clear Creek, the projected new facility construction for the 1977-1983 time period includes:

1) Two new treatment plants with a total projected capacity of 1.4 MGD average daily flow.
2) Upgrading of three existing plants from level 2 treatment to level 3NP treatment.
3) New collection systems serving an additional 19,230 persons.

Facilities projected for the 1984-1990 time period include:

1) Three plant expansions increasing capacity by 1.4 MGD and level of treatment from 3NP to 4NPA, pending verification of this need.
2) Upgrading of five existing plants from level 3NP to level 4NPA, pending verification of this need.
3) New collection systems with capacity for 15,020 persons.

It should be noted that the ongoing planning studies identified for the nontidal segment of Clear Creek may result in alternative allocations as previously discussed. Items still in question such as interbasin transport and phosphorus removal may impact greatly on the facility phasing tables and projected costs for the area, especially during the 1984-1990 time frame since most of the upgrading to level 4NPA would occur during this period.

Facilities projected for the 1991-1995 time period include:

1) One plant expansion of 0.05 MGD.

TABLE IV-1
CLEAR CREEK NONTIDAL
SCHEDULE OF PROJECTED CONSTRUCTION NEEDS

Geographical Planning Area	Plant Or Service Area	Existing Capacity Treatment Level	Projected Construction Needs			Estimated Dry Weather Flow/ Total Capacity Available (MGD)				Comments
			1977-1983	1984-1990	1991-1995	1977	1983	1990	1995	
CL-1	Pearland 2	1.0/2	Upgrade to 3NP Collect - 1680	Upgrade/Expand to 1.2/4NPA Collect - 1470	Collect - 1050	0.82/1.0	0.95/1.0	1.1/1.2	1.2/1.2	Phosphorous removal requirements for all plants in the basin are subject to results of Clear Lake eutrophication study to be completed by 1983. Upgrading to 4NA is based upon resolution of the interbasin transport alternative by 1983. Should interbasin transport be found an implementable plan, plants in CL-1 may require upgrading to 4N. Plants in CL-2 will be transported outside of the basin and can operate at Level 2.
	Pearland 3	0.5/2	Upgrade to 3NP Collect - 900	Upgrade/Expand to 0.7/4NPA Collect - 780	Collect - 560	0.29/0.5	0.42/0.5	0.58/0.7	0.7/0.7	
	Pearland 4	0.25/2	Upgrade to 3NP Collect - 800	Upgrade to 4NPA Collect - 700	Expand to 0.3/4NPA Collect - 500	0.14/0.25	0.19/0.25	0.25/0.25	0.3/0.3	
	New Plant 1	-	New plant at 0.8/3NP Collect - 8000	Upgrade to 4NPA	-	0.0/0.0	0.8/0.8	0.8/0.8	0.8/0.8	
	New Plant 2	-	New plant at 0.6/3NP Collect - 800	Upgrade to 4NPA Collect - 3200	Collect - 2000	0.0/0.0	0.08/0.6	0.4/0.6	0.6/0.6	
CL-2	Southeast	3.0/3NP	Collect - 2610	Upgrade to 4NPA Collect - 3100	Collect - 2700	1.0/3.0	1.3/3.0	1.6/3.0	2.0/3.0	Phasing for plants in CL-2 are based on preliminary Facility Planning information.
	Sagemont	5.0/3NP	Collect - 2730	Upgrade to 4NPA Collect - 3790	Collect - 4700	1.3/5.0	1.7/5.0	2.5/5.0	3.4/5.0	
	Gulf Meadows	1.0/3NP	Collect - 1710	Upgrade/Expand to 2.0/4NPA Collect - 1980	Collect - 1860	0.60/1.0	0.80/2.0	1.1/2.0	1.3/2.0	
					Total Flow/Capacity	4.2/10.8	6.2/13.2	8.3/13.6	10.3/13.6	

Notes: 1) Existing Capacity/Treatment Level based on information provided by the municipal inventory (Activity 3) or Facility Plans.
2) See Table IV-2 for costs.

TABLE IV-2
CLEAR CREEK NONTIDAL BASIN
ESTIMATED COSTS OF WASTEWATER TREATMENT

Geographical Planning Area	Plant or Service Area	Estimated Capital Costs						Estimated Annual Operation and Maintenance Costs						Comments
		1977-1983		1984-1990		1991-1995		1977-1983		1984-1990		1991-1995		
		Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	
CL-1	Pearland 2	948,000	370,000	1,566,000	323,000	0	231,000	157,000	10,000	189,000	12,000	189,000	14,000	
	Pearland 3	720,000	198,000	1,506,000	172,000	0	123,000	114,000	5,000	142,000	6,000	142,000	7,000	
	Pearland 4	588,000	176,000	224,000	154,000	811,000	110,000	88,000	2,000	94,000	3,000	94,000	4,000	
	New Plant 1	1,836,000	1,760,000	274,000	0	0	0	143,000	12,000	155,000	12,000	155,000	12,000	
	New Plant 2	1,572,000	176,000	262,000	704,000	0	440,000	122,000	1,000	135,000	6,000	135,000	9,000	
CL-2	Southeast	0	574,000	492,000	682,000	0	594,000	320,000	15,000	357,000	20,000	357,000	24,000	
	Sagemont	0	601,000	510,000	834,000	0	1,034,000	456,000	14,000	500,000	19,000	500,000	26,000	
	Gulf Meadows	0	376,000	2,624,000	436,000	0	409,000	157,000	9,000	275,000	12,000	275,000	15,000	
	Subtotal	5,664,000	4,231,000	7,458,000	3,705,000	811,000	2,941,000	1,557,000	68,000	1,847,000	90,000	1,847,000	111,000	
	Total by Period	9,895,000		10,763,000		3,752,000		1,625,000		1,937,000		1,958,000		
	Amortized Capital Cost							817,000		1,706,000		2,016,000		
	Total Annual Cost							2,442,000		3,643,000		3,974,000		
	Cost/1000 gal							$1.29		$1.39		$1.17		

Notes: 1) See Table IV-1 for construction actions required.
2) Capital costs amortized at 7% over 30 years.
3) Costs based on 1975 dollars.

2) Additional collection facilities serving an additional 13,370 persons in the area.

The associated cost estimates for capital and operational and maintenance expenses are summarized in Table IV-3. Also included in the Table is an estimated cost per 1000 gallons for wastewater treatment based on average daily dry weather flow during the time period.

TABLE IV-3

SUMMARY OF ESTIMATED COSTS *
CLEAR CREEK NONTIDAL

Period	Capital Cost (Total)	O & M Cost (Annual Avg.)	Total Cost ($/1000 Gallons)
1977 - 1983	9,900,000	1,630,000	1.29
1984 - 1990	10,800,000	1,940,000	1.39
1991 - 1995	3,750,000	1,960,000	1.17

* Costs based on 1975 dollars.

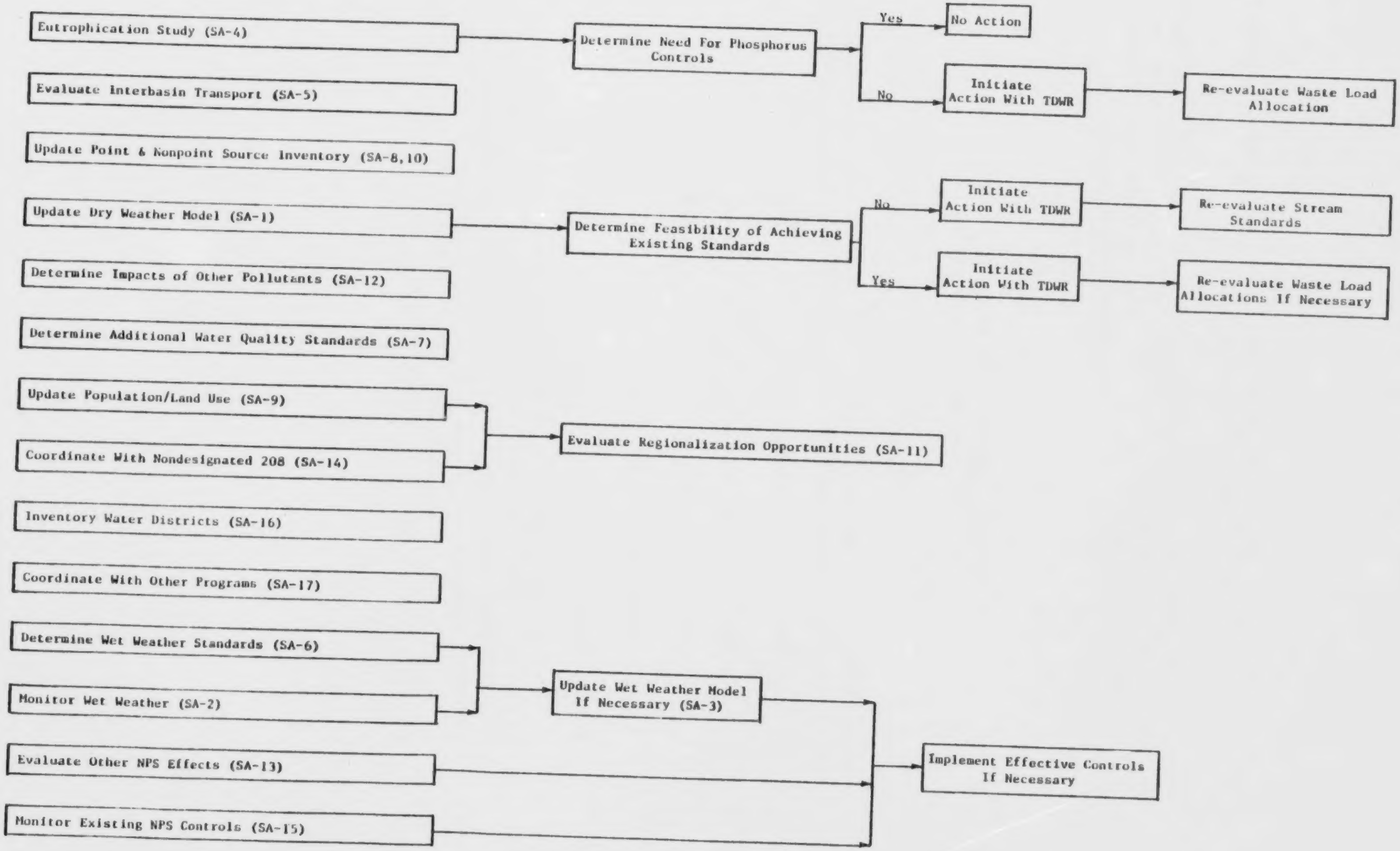
Action Check List

Items required to implement the 208 plan in Clear Creek nontidal have been identified in this Chapter. Figure IV-1 presents the interrelationships between activities, decisions, and ongoing planning efforts. Special activities (SA) identified in the figure refer to those previously described. Priorities and further definition for the special activities were presented in Chapter II.

FIGURE IV-1

INTERRELATIONSHIP OF IMPLEMENTATION REQUIREMENTS

CLEAR CREEK NONTIDAL


Eutrophication Study (SA-4)
Evaluate Interbasin Transport (SA-5)
Update Point & Nonpoint Source Inventory (SA-8,10)
Update Dry Weather Model (SA-1)
Determine Impacts of Other Pollutants (SA-12)
Determine Additional Water Quality Standards (SA-7)
Update Population/Land Use (SA-9)
Coordinate With Nondesignated 208 (SA-14)
Inventory Water Districts (SA-16)
Coordinate With Other Programs (SA-17)
Determine Wet Weather Standards (SA-6)
Monitor Wet Weather (SA-2)
Evaluate Other NPS Effects (SA-13)
Monitor Existing NPS Controls (SA-15)
Determine Need For Phosphorus Controls
Yes
No Action
No
Initiate Action With TDWR
Re-evaluate Waste Load Allocation
Determine Feasibility of Achieving Existing Standards
No
Initiate Action With TDWR
Re-evaluate Stream Standards
Yes
Initiate Action With TDWR
Re-evaluate Waste Load Allocations If Necessary
Evaluate Regionalization Opportunities (SA-11)
Update Wet Weather Model If Necessary (SA-3)
Implement Effective Controls If Necessary

Clear Creek - Tidal (Segment 1101)

Technical Subplan

Point Sources. The technical subplan for point source discharges includes the following:

1) Operate existing and future wastewater treatment facilities at current permit levels.

2) Consider elimination of the phosphorus requirement based on the results of the recommended Clear Lake eutrophication study.

3) Consider maximum limits on chlorine residual in plant effluent.

Nonpoint Sources. Nonpoint source wasteloads, except those due to dredging activities, were not projected to be a major concern in dry weather relative to the fishable/swimmable parameters of D.O. and fecal coliform. No specific modeling was performed for wet weather conditions in this segment. Therefore, no definitive conclusions can be developed. The only specific recommendation is to prohibit dredging activities during dry weather conditions to minimize the effect of the additional wasteloads.

It is possible that nonpoint source wasteloads could create similar conditions as those projected for the nontidal segment of Clear Creek. Therefore, the 208 technical subplan recommends that best management practices be encouraged to reduce the amount of nonpoint source pollutants washed into the Creek. Further, if wet weather monitoring indicates a potential problem, actions similar to those addressed in the Clear Creek nontidal segment should be implemented.

Other. Additional recommendations for the subbasin include:

1) Formulate wet weather standards consistent with dry weather uses.

2) Implement dry weather and wet weather monitoring to verify conclusions.

Impact on Regulatory Function

Permitting. The 208 plan recommends that the existing level of permitted discharge in the tidal segment of Clear Creek be continued. The general level throughout the basin is effluent set 3NP.

The major impact on permitting in the Clear Creek tidal segment due to the 208 plan relates to the recommendations for maximum chlorine residuals and elimination of the phosphorus removal requirements. The impacts related to these items are the same as those presented in the nontidal segment of Clear Creek.

Monitoring. Monitoring efforts in the tidal segment of Clear Creek will continue to assess the segment water quality, effluent water quality and ongoing planning requirements through the existing mechanisms. Additional monitoring efforts in the subbasin should be dictated by ongoing planning requirements and be directed toward verification and updating of the data base and existing conclusions. Special emphasis should be directed toward wet weather water quality to verify the predicted water quality or identify nonpoint source problem areas.

Stream Standards. Dry weather standards for water quality in Clear Creek tidal are recommended to be consistent with fishable/swimmable water quality criteria for the 208 area (i.e. D.O. $\geq$ 5.0 mg/1 and fecal coliform less than 200 MPN/100 ml).

Wet weather water quality standards have not yet been defined for Clear Creek. However, a special program has been defined as the basis for developing the wet weather water quality criteria, including parameters and numerical values, consistent with water uses on which the dry weather standards are based. This program is further described later in this section.

Allocations. The 208 plan recommends that the existing wasteload allocations developed by the TDWR be continued in Clear Creek. This recommendation is based on uncalibrated and unverified modeling techniques and base line data. Ongoing planning recommendations include updating the data base and monitoring to verify the modeling conclusions. This segment has been classified by the TDWR as Water Quality (WQ) Limited.

Special Activities Required to Implement

A complete list of the continuing planning activities and special programs recommended as part of the 208 plan was presented in Chapter II. Programs pertaining to the tidal segment of Clear Creek are summarized below. A complete description of the program is contained in the Appendix.

1) Monitor dry weather water quality. Emphasis should be on verification of quality predictions and development of data base.

2) Monitor wet weather water quality. Emphasis should be on verification of assumed quality and development of baseline data.

3) Initiate eutrophication study in Clear Lake drainage basin. Emphasis should be on total phosphorus loading and sources. Results will be utilized in determining the cost effectiveness of existing point source phosphorus controls.

4) Determine wet weather water quality standards. Parameters and numerical values should be consistent with dry weather water uses.

5) Determine maximum chlorine residuals which will be consistent with fishable/swimmable conditions; consider modifying permits accordingly.

6) Update the point source inventory. Emphasis should be directed toward maintaining accurate and up-to-date information that is easily updated. This will provide input to future planning efforts.

7) Update the population and land use data. Emphasis should be on computerization of data base to allow greatest flexibility of the data. Applications of this activity include re-evaluation of allocations, nonpoint source wasteload evaluation, problem area prediction, etc.

8) Update nonpoint source wasteload identification and projections. Emphasis should be directed toward verifying wet weather conditions as well as determining dry weather contributions. Information developed should be incorporated into the existing steady-state and nonsteady-state models where applicable.

9) Evaluate regionalization opportunities. Emphasis should be on coordination of the 201 program and evaluation of planning areas during the pre-grant application phase.

10) Determine impacts of other pollutants on Clear Creek water quality. Emphasis should be on heavy metals and toxic materials as well as suspended solids.

11) Evaluate impacts of nonpoint source wasteloads on a basis other than the effects on water quality. Emphasis should be directed toward erosion, flood control, transportation, air quality, etc. The results will be used to interface with other environmental programs as required by 208.

12) Coordinate the nondesignated area 208 plan with the designated area 208 plan in order to efficiently implement the recommendations.

13) Monitor and analyze all existing nonpoint source controls in the Clear Creek area. Emphasis should be on cataloguing controls and evaluating performance in order to develop a data base for a refined nonpoint source control program throughout the area.

14) Inventory and map all existing water districts and service areas in the segment. This effort will be part of the updated data base for ongoing planning.

15) Coordinate 208 plans and implementations with other environmental programs including air quality, transportation, solid waste, 201, 303, coastal management, and parks/recreation projects.

Phasing and Costs

Population and land use projections along with existing 201 plans were utilized as the basis for projecting the future wastewater treatment and conveyance system facility needs in the tidal segment of Clear Creek. Table IV-4 presents the phasing for three distinct time periods, for municipal facilities on a geographical planning area basis. Table IV-5 presents the associated cost estimates, both capital and operational and maintenance, for the projected facilities, also on a geographical planning area basis.

In Clear Creek tidal, the projected new facility construction for the 1977-1983 time period includes:

1) Two plant expansions, increasing capacity by 3.37 MGD.

2) Upgrading of three treatment plants from level 2 to level 3NP.

TABLE IV-4
CLEAR CREEK TIDAL, CLEAR LAKE, ARMAND BAYOU & DICKINSON BAYOU
SCHEDULE OF PROJECTED CONSTRUCTION NEEDS

Geographical Planning Area	Plant Or Service Area	Existing Capacity Treatment Level	Projected Construction Needs			Estimated Dry Weather Flow/ Total Capacity Available (MGD)				Comments
			1977-1983	1984-1990	1991-1995	1977	1983	1990	1995	
CL-3 CL-4	Blackhawk Regional	3.25/3NP	Expand to 6.5/3NP Collect - 28,000	Collect - 19,000	Expand to 9.75/3N Collect - 7000	0.0/0.0	3.6/6.5	6.2/9.75	8.8/9.75	Based on Facility Plan information.
CL-5	Webster	0.3/2	Upgrade/Expand to 0.42/3NP Collect - 850	Collect - 500	Collect - 300	0.47/0.3	0.34/0.42	0.39/0.42	0.42/0.42	Phosphorous removal requirements for all plants in Clear Lake drainage basin are subject to results of Clear Lake eutrophication study to be completed by 1983.
	Nassau Bay	0.75/4	Upgrade to 4NP Collect - 2280	Collect - 250	Collect - 180	0.74/0.75	0.75/0.75	0.74/0.75	0.72/0.75	
CL-6	League City 1	1.5/2	Upgrade to 3NP Collect - 1110	Collect - 970	Collect - 700	1.2/1.5	1.3/1.5	1.4/1.5	1.4/1.5	
	League City 2	0.25/2	Upgrade to 3NP -	-	Collect - 70	0.12/0.25	0.13/0.25	0.13/0.25	0.13/0.25	
					Total Flow/Capacity	2.5/2.8	6.1/9.4	8.9/12.7	11.5/12.7	
CL-7	WCID 75 (Timbercove)	0.15/2	Upgrade to 3NP Collect - 120	Collect - 110	Collect - 80	0.06/0.15	0.07/0.15	0.08/0.15	0.09/0.15	
	WCID 50 (El Lago)	0.5/4N	Upgrade to 4NP Collect - 280	Collect - 240	Collect - 170	0.36/0.5	0.38/0.5	0.41/0.5	0.43/0.5	
	Shoreacres	0.28/2	Upgrade to 3NP -	-	-	0.32/0.28	0.30/0.28	0.28/0.28	0.27/0.28	
	GC WCID 12 (Clearlake Shores)	0.45/2	Upgrade to 3NP -	-	-	0.31/0.45	0.28/0.45	0.24/0.45	0.22/0.45	
					Total Flow/Capacity	1.0/1.4	1.0/1.4	1.0/1.4	1.0/1.4	
AB-1	Clear Lake Authority	5.5/3NP	Collect - 10,200	Collect - 9000	Collect - 6400	2.5/5.5	3.2/5.5	4.0/5.5	4.6/5.5	
AB-3	College View	0.4/2	Upgrade to 3NP Collect - 1460	Collect - 630	Collect - 480	0.19/0.4	0.23/0.4	0.29/0.4	0.35/0.4	
					Total Flow/Capacity	2.7/5.9	3.4/5.9	4.3/5.9	5.0/5.9	
DB-1	Friendswood 3	0.4/2	-	-	-	0.22/0.4	0.2/0.4	0.19/0.4	0.18/0.4	Phosphorous removal requirements for all plants in tidal basin are subject to results of Dickinson Bayou Tidal eutrophication study to be completed by 1983.
	Bayridge	0.5/2	Upgrade to 2P Collect - 990	-	Collect - 250	0.08/0.5	0.11/0.5	0.1/0.5	0.14/0.5	
	Galv. Co. WCID 2	0.5/2	Upgrade to 2P Collect - 780	Collect - 690	Collect - 490	0.37/0.5	0.45/0.5	0.52/0.5	0.57/0.5	
	Galv. Co. WCID 1	4.2/2	Upgrade to 2P Collect - 3300	Collect - 1600	Collect - 1500	2.6/4.2	2.7/4.2	2.8/4.2	3.0/4.2	
					Total Flow/Capacity	3.3/5.2	3.5/5.2	3.6/5.2	3.9/5.2	

Notes: 1) Existing Capacity/Treatment Level based on information provided by the municipal inventory (Activity 3) or Facility Plans.
2) See Table IV-[illegible] for costs.

TABLE IV-5
CLEAR CREEK TIDAL, CLEAR LAKE, ARMAND BAYOU, AND DICKINSON BAYOU
ESTIMATED COSTS OF WASTEWATER TREATMENT

Geographical Planning Area	Plant or Service Area	Estimated Capital Costs						Estimated Annual Operation and Maintenance Costs						Comments
		1977-1983		1984-1990		1991-1995		1977-1983		1984-1990		1991-1995		
		Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	
CL-3 CL-4	BLACKHAWK REGIONAL	4,200,000	6,160,000	0	4,180,000	4,200,000	1,540,000	596,000	95,000	596,000	95,000	744,000	105,000	
CL-5	WEBSTER	1,464,000	187,000	0	110,000	0	66,000	106,000	5,000	106,000	6,000	106,000	6,000	
	NASSAU BAY 1	708,000	502,000	0	55,000	0	40,000	149,000	10,000	149,000	11,000	149,000	11,000	
CL-6	LEAGUE CITY 1	1,080,000	244,000	0	213,000	0	154,000	201,000	16,000	201,000	18,000	201,000	19,000	
	LEAGUE CITY 2	588,000	0	0	15,000	0	0	88,000	1,000	88,000	1,000	88,000	1,000	
	Subtotal	8,040,000	7,093,000	0	4,573,000	4,200,000	1,800,000	1,140,000	98,000	1,140,000	131,000	1,288,000	142,000	
	Total by Period	15,133,000		4,573,000		6,000,000		1,238,000		1,271,000		1,430,000		
							Amortized Capital Cost	1,250,000		1,628,000		2,123,000		
							Total Annual Cost	2,488,000		2,899,000		3,553,000		
							Cost/1000 gal	$1.59		$1.06		$.95		
CL-7	WCID 75	486,000	26,000	0	24,000	0	18,000	69,000	5,000	69,000	5,000	69,000	5,000	
	WCID 50 (El LAGO)	228,000	62,000	0	53,000	0	37,000	124,000	3,000	124,000	4,000	124,000	4,000	
	SHORE ACRES	588,000	0	0	0	0	0	88,000	8,000	88,000	8,000	88,000	8,000	
	GC WICD 12	684,000	0	0	0	0	0	108,000	4,000	108,000	4,000	108,000	4,000	
	Subtotal	1,986,000	88,000	0	77,000	0	55,000	389,000	20,000	389,000	21,000	389,000	21,000	
	Total by Period	2,074,000		77,000		55,000		409,000		410,000		410,000		
							Amortized Capital Cost	171,000		178,000		182,000		
							Total Annual Cost	580,000		588,000		592,000		
							Cost/1000 gal	$1.59		$1.61		$1.62		
AB-1	CLEAR LAKE WATER AUTHORITY	0	2,244,000	0	1,980,000	0	1,408,000	490,000	49,000	490,000	58,000	490,000	68,000	
AB-3	COLLEGE VIEW	678,000	321,000	0	139,000	0	106,000	106,000	4,000	106,000	4,000	106,000	5,000	
	Subtotal	678,000	2,565,000	0	2,119,000	0	1,514,000	596,000	53,000	596,000	62,000	596,000	73,000	
	Total by Period	3,243,000		2,119,000		1,514,000		649,000		658,000		669,000		
							Amortized Capital Cost	268,000		443,000		568,000		
							Total Annual Cost	917,000		1,101,000		1,237,000		
							Cost/1000 gal	$.78		$.78		$.73		
DB-1	FRIENDSWOOD 3	0	0	0	0	0	0	61,000	1,000	61,000	1,000	61,000	1,000	
	BAYRIDGE	228,000	218,000	0	0	0	55,000	83,000	2,000	83,000	2,000	83,000	2,000	
	GC WCID 2	228,000	172,000	0	152,000	0	108,000	83,000	6,000	83,000	7,000	83,000	7,000	
	GC WCID 1	564,000	726,000	0	309,000	0	330,000	291,000	22,000	291,000	24,000	291,000	26,000	
	Subtotal	1,020,000	1,116,000	0	461,000	0	493,000	518,000	31,000	518,000	34,000	518,000	36,000	
	Total by Period	2,136,000		461,000		493,000		549,000		552,000		554,000		
							Amortized Capital Cost	176,000		215,000		255,000		
							Total Annual Cost	725,000		767,000		809,000		
							Cost/1000 gal	$.58		$.59		$.59		

Notes: 1) See Table IV-4 for construction actions required.
2) Capital costs amortized at 7½% over 30 years.
3) Costs based on 1975 dollars.

3) New collection systems serving an additional 32,240 persons.

Facilities projected for the 1984-1990 time period are only related to expanding the existing collection systems. New collection facilities serving an additional 20,720 persons are projected.

Facilities projected for the 1991-1995 time period include:

1) One plant expansion of 3.75 MGD.

2) Additional collection facilities serving an additional 8,250 persons in the area.

The associated cost estimates for capital and operational and maintenance expenses are summarized in Table IV-6. Also included in the Table is an estimated cost per 1000 gallons for wastewater treatment based on average daily dry weather flow during the time period.

TABLE IV-6

SUMMARY OF ESTIMATED COSTS*
CLEAR CREEK TIDAL

Period	Capital Cost (Total)	O & M Cost (Annual Avg.)	Total Cost ($/1000 Gallons)
1977 - 1983	15,100,000	1,240,000	1.59
1984 - 1990	4,570,000	1,710,000	1.22
1991 - 1995	6,000,000	1,430,000	0.95

* Costs based on 1975 dollars.

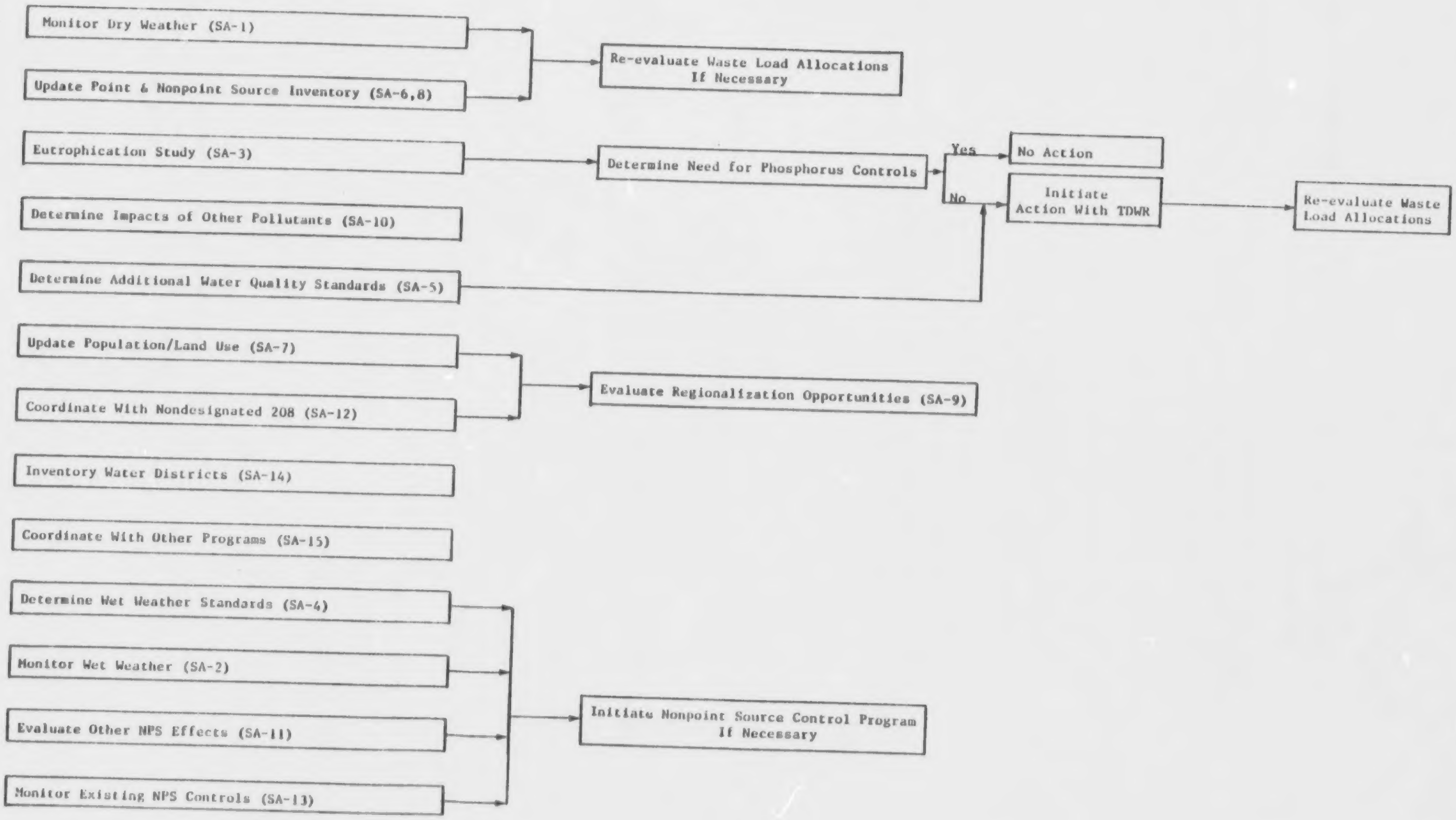
Action Check List

Items required to implement the 208 plan in the Clear Creek tidal basin have been identified in this Chapter. Figure IV-2 presents the interrelationships between activities, decisions, and ongoing planning efforts. Special activities (SA) identified in the figure refer to those previously described. Priorities and further definition for the special activities were presented in Chapter II.

FIGURE IV-2

INTERRELATIONSHIP OF IMPLEMENTATION REQUIREMENTS

CLEAR CREEK TIDAL


Monitor Dry Weather (SA-1)
Update Point & Nonpoint Source Inventory (SA-6,8)
Re-evaluate Waste Load Allocations If Necessary
Eutrophication Study (SA-3)
Determine Need for Phosphorus Controls
Yes
No
No Action
Initiate Action With TDWR
Re-evaluate Waste Load Allocations
Determine Impacts of Other Pollutants (SA-10)
Determine Additional Water Quality Standards (SA-5)
Update Population/Land Use (SA-7)
Coordinate With Nondesignated 208 (SA-12)
Evaluate Regionalization Opportunities (SA-9)
Inventory Water Districts (SA-14)
Coordinate With Other Programs (SA-15)
Determine Wet Weather Standards (SA-4)
Monitor Wet Weather (SA-2)
Evaluate Other NPS Effects (SA-11)
Monitor Existing NPS Controls (SA-13)
Initiate Nonpoint Source Control Program If Necessary

Clear Lake (Segment 2425)

Technical Subplan

Point Sources. The technical subplan for point source discharges includes the following:

1) Operate existing and future wastewater treatment facilities at the existing permit levels.

2) Consider eliminating the phosphorus removal requirement based on the results of the recommended eutrophication study.

3) Consider maximum limit on chlorine residual in plant effluent.

Nonpoint Sources. Nonpoint source wasteloads, except for dredging related activities, were not projected to be a major concern relative to the fishable/swimmable parameters of D.O. and fecal coliform. However, nonpoint sources were identified as a contributing factor to the total phosphorus loading into Clear Lake. Additional nonpoint sources of phosphorus from tidal influence were not identified but are potentially significant.

The 208 technical subplan recommends that best management practices be encouraged to reduce the amount of nonpoint source pollutants washed into Clear Lake. Additionally, a eutrophication study to identify the sources and total loading of phosphorus into the Lake is recommended.

Other. Additional items included as part of the Clear Lake technical subplan are:

1) Formulate wet weather water quality standards consistent with fishable/swimmable uses.

2) Implement field monitoring to verify the conclusions of wet weather and dry weather water quality simulations.

Impact on Regulatory Functions

Permitting. The 208 program recommends that the existing level of permitted discharge in Clear Lake be continued. The general level throughout the basin is modified effluent set 3NP (BOD = 5 mg/l, TSS = 12 mg/l, NH_3 - N = 5 mg/l, P = 2 mg/l).

An impact on permitting may occur if the results of the eutrophication study on the greater Clear Lake drainage basin indicate that the phosphorus requirement is not cost effective.

An additional impact on permitting will result if requirements for maximum chlorine residuals are implemented in the basin. Limits on chlorine residual should be considered to protect Clear Lake and its aquatic environment from the possibly toxic effects of excessive chlorine and the formation of chlorinated hydrocarbons.

Monitoring. Monitoring efforts in Clear Lake will continue to assess the segment water quality and effluent water quality through the existing mechanisms. Additional monitoring in the subbasin should be dictated by ongoing planning requirements and verification and updating of the initial data base. Included among these items are: population/land use, dry weather water quality, wet weather water quality, phosphorus loading evaluation, etc.

Stream Standards. Dry weather standards for Clear Lake water quality are recommended to be consistent with fishable/swimmable water quality criteria for the 208 area (i.e., D.O. $\geq$ 5.0 mg/l and fecal coliform less than 200 MPN/100 ml).

Wet weather water quality standards have not yet been defined for Clear Lake. However, a special program has been defined as the basis for developing the wet weather water quality criteria, including parameters and numerical values consistent with water uses on which the dry weather standards are based. This program is detailed elsewhere in this report.

Allocations. The 208 plan recommends that the existing wasteload allocations developed by the TDWR be continued in Clear Lake. This recommendation is based on uncalibrated and unverified simulation modeling techniques and base line data. Ongoing planning recommendations include updating the data base and monitoring to verify the modeling conclusions. Clear Lake has been classified by the TDWR as Effluent Limited (EL).

Special Activities Required to Implement

A complete list of the continuing planning activities and special programs recommended as part of the 208 plan was presented in Chapter II. Programs pertaining to Clear Lake are summarized below. A complete description of the program is contained in the Appendix.

1) Monitor dry weather water quality. Emphasis should be on verification of quality predictions and development of a data base.

2) Monitor wet weather water quality. Emphasis should be on verification of assumed quality and development of baseline data.

3) Initiate eutrophication study in Clear Lake drainage basin. Emphasis should be on total phosphorus loading and sources. Results will be utilized in determining the cost effectiveness of existing point source phosphorus controls.

4) Determine wet weather water quality standards. Parameters and numerical values should be consistent with dry weather water uses.

5) Determine maximum chlorine residuals which will be consistent with fishable/swimmable conditions; consider modifying permits accordingly.

6) Update the point source inventory in the segment. Emphasis should be directed toward maintaining accurate and up-to-date information that is easily updated. This will provide input to future planning efforts.

7) Update the population and land use data. Emphasis should be on computerization of data base to allow greatest flexibility of the data. Applications of this activity include re-evaluation of allocations, nonpoint source wasteload evaluation, problem area prediction, etc.

8) Update nonpoint source wasteload identification and projections. Emphasis should be directed toward verifying wet weather conditions as well as determining dry weather contributions in the segment. Information developed should be incorporated into the existing steady-state and nonsteady-state models where applicable.

9) Evaluate regionalization opportunities. Emphasis should be on coordination of the 201 program and evaluation of planning areas during the pre-grant application phase.

10) Determine impacts of other pollutants on Clear Lake water quality. Emphasis should be on heavy metals and toxic materials as well as suspended solids.

11) Evaluate impacts of nonpoint source wasteloads on a basis other than the effects on water quality. Emphasis should be directed toward erosion, flood control, transportation, air quality, etc. The results will be used to interface with other environmental programs as required by 208.

12) Coordinate the nondesignated area 208 plan with the designated area 208 plan in order to efficiently implement the recommendations.

13) Monitor and analyze all existing nonpoint source controls in the Clear Lake area. Emphasis should be on cataloguing controls and evaluating performance in order to develop data base for a refined nonpoint source control program throughout the area.

14) Inventory and map all existing water districts and service areas in the segment. This effort will be part of the updated data base for ongoing planning.

15) Coordinate 208 plans and implementations with other environmental programs including air quality, transportation, solid waste, 201, 303, coastal management, and parks/recreation projects.

Phasing and Costs

Population and land use projections along with existing 201 plans, were utilized as the basis for projecting the future wastewater treatment and conveyance system needs in Clear Lake. Table IV-4 presents the phasing for three distinct time periods, for new municipal facilities broken down by geographical planning area. Table IV-5 presents the associated cost estimates, both capital and operational and maintenance, for the projected facilities.

In the Clear Lake segment, the projected new facility construction for the 1977-1983 time period includes:

1) Upgrading of four existing plants, three from effluent set 2 to effluent set 3NP and one from effluent set 4N to 4NP.

2) Additional collection facilities serving 400 persons.

Projected facilities for the 1984-1990 time period include additional collection systems serving 350 persons. In the final time period, 1991-1995 additional collection facilities are projected for 250 persons.

The associated estimated costs for capital expenses and annual operational and maintenance expenses are summarized in Table IV-7. Also included in the Table is an estimate for the total cost per 1000 gallons for wastewater treatment based on average daily dry weather flow during the time period.

TABLE IV-7

SUMMARY OF ESTIMATED COSTS*
CLEAR LAKE

Period	Capital Cost (Total)	O & M Cost (Annual Avg.)	Total Cost ($/1000 Gallons)
1977 - 1983	2,070,000	410,000	1.59
1984 - 1990	77,000	410,000	1.61
1991 - 1995	55,000	410,000	1.62

* Costs based on 1975 dollars.

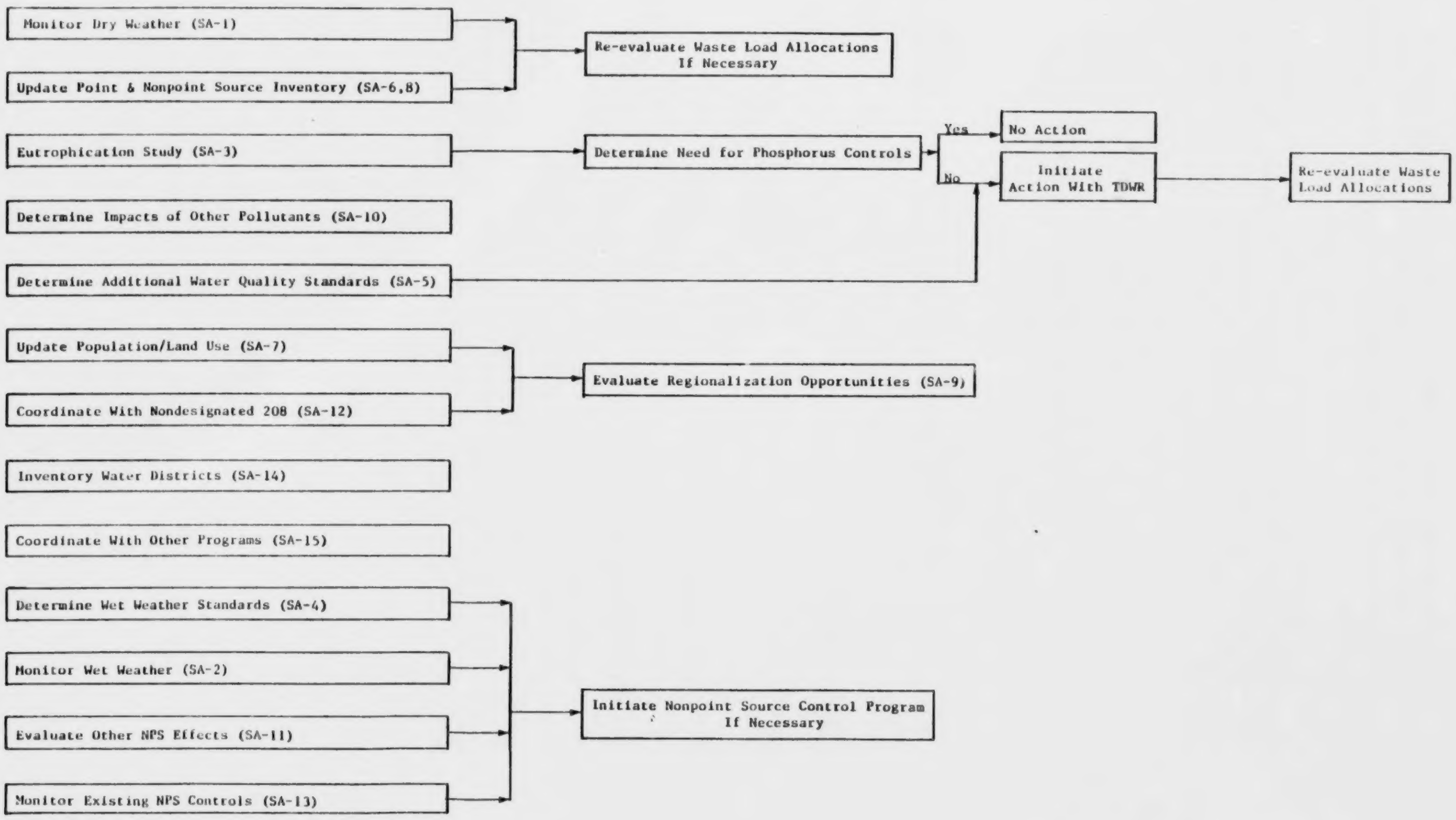
Action Check List

Items required to implement the 208 plan in the Clear Lake segment have been identified in the chapter. Figure IV-3 presents the relationship between these items and other ongoing planning activities. Special activities (SA) identified in the flow chart refer to those previously described. Priorities for these special activities were presented in Chapter II.

FIGURE IV-3

INTERRELATIONSHIP OF IMPLEMENTATION REQUIREMENTS

CLEAR LAKE



Monitor Dry Weather (SA-1)
Update Point & Nonpoint Source Inventory (SA-6,8)
Re-evaluate Waste Load Allocations If Necessary
Eutrophication Study (SA-3)
Determine Need for Phosphorus Controls
Yes
No Action
No
Initiate Action With TDWR
Re-evaluate Waste Load Allocations
Determine Impacts of Other Pollutants (SA-10)
Determine Additional Water Quality Standards (SA-5)
Update Population/Land Use (SA-7)
Coordinate With Nondesignated 208 (SA-12)
Evaluate Regionalization Opportunities (SA-9)
Inventory Water Districts (SA-14)
Coordinate With Other Programs (SA-15)
Determine Wet Weather Standards (SA-4)
Monitor Wet Weather (SA-2)
Evaluate Other NPS Effects (SA-11)
Monitor Existing NPS Controls (SA-13)
Initiate Nonpoint Source Control Program If Necessary

Armand Bayou

Technical Subplan

Point Sources. The technical subplan for point source discharges includes the following:

1) Operate existing and future wastewater treatment facilities at the existing permit levels.

2) Consider elimination of the phosphorus requirement based on the results of the recommended Clear Lake eutrophication study.

3) Consider maximum limits on chlorine residual in plant effluent.

Nonpoint Sources. Dry weather related nonpoint source wasteloads were not projected to present a major concern for water quality in Armand Bayou. No simulation modeling was performed to predict wet weather water quality and related nonpoint source wasteloads. Therefore, no definitive conclusions can be made.

It is possible that nonpoint source wasteloads could create similar conditions to those projected for the nontidal segment of Clear Creek. Therefore, the 208 technical subplan recommends that best management practices be encouraged to reduce the amount of nonpoint source pollutants washed into the bayou. Furthermore, if wet weather monitoring indicates a potential problem, actions similar to those addressed in the Clear Creek nontidal segment should be implemented.

Other. Additional recommendations for Armand Bayou include:

1) Classify Armand Bayou as a stream segment.

2) Formulate dry weather water quality standards consistent with water uses.

3) Formulate wet weather water quality standards consistent with dry weather uses.

4) Initiate a water quality monitoring program to develop a calibrated and verified simulation model and to verify the existing conclusions of dry and wet weather water quality.

Impact on Regulatory Functions

Permitting. The 208 plan recommends that the existing level of permitted discharge into Armand Bayou be continued. The general level throughout the subbasin is effluent set 3NP.

The major impact on permitting in Armand Bayou due to the 208 plan relates to the recommendations for maximum chlorine residuals and elimination of the phosphorus removal requirements. The impacts related to these items are the same as those described in the Clear Creek nontidal section.

Monitoring. Monitoring efforts in Armand Bayou will continue to assess the segment water quality, effluent quality, and ongoing planning requirements through the existing mechanisms. Additional monitoring efforts in the subbasin should be directed toward verification of water quality assumptions, steady-state model development, and updating of baseline information.

Stream Standards. Dry weather standards for water quality in Armand Bayou are presently recommended to be consistent with fishable/swimmable water quality criteria for the 208 area (i.e., D.O. ≥ 5.0 mg/l and fecal coliform less than 200 MPN/100 ml). However, this recommendation is subject to review and change as part of the classification process.

Wet weather quality standards have not yet been defined for Armand Bayou. However, a special program has been defined as the basis for developing the wet weather quality criteria, including parameters and numerical values, consistent with water uses on which the dry weather standards are based. This program is further described later in this section.

Allocations. It is recommended that wasteload allocations be developed in conjunction with the stream classification process.

Special Activities Required to Implement

A complete list of the continuing planning activities and special programs recommended as part of the 208 plan was presented in Chapter II. Specific programs pertaining to Armand Bayou are summarized below. A complete description of the program is contained in the Appendix.

1) Develop steady-state water quality simulation model. Emphasis should be directed toward calibration and verification of loadings, parameters, and rate constants.

2) Define water quality uses and numerical standards as part of the classification process.

3) Monitor wet weather water quality. Emphasis should be on verification of assumed quality and development of baseline data.

4) Initiate eutrophication study in Clear Lake drainage basin. Emphasis should be on total phosphorus loading and sources. Results will be utilized in determining the cost effectiveness of existing point source phosphorus controls.

5) Determine wet weather water quality standards. Parameters and numerical values should be consistent with dry weather water uses.

6) Determine maximum chlorine residuals which will be consistent with fishable/swimmable conditions; consider modifying permits accordingly.

7) Update the point source inventory in the segment. Emphasis should be directed toward maintaining accurate and up-to-date information that is easily updated. This will provide input to future planning efforts.

8) Update the popluation and land use data. Emphasis should be on computerization of data base to allow greatest flexibility of the data. Applications of this activity include re-evaluation of allocations, nonpoint source wasteload evaluation, problem area prediction, etc.

9) Update nonpoint source wasteload identification and projections. Emphasis should be directed toward dry weather contributions in the segment. Information developed should be incorporated into the existing steady-state model where applicable.

10) Evaluate regionalization opportunities. Emphasis should be on coordination of the 201 program and evaluation of planning areas during the pre-grant application phase.

11) Determine impacts of other pollutants on Armand Bayou water quality. Emphasis should be on heavy metals and toxic materials as well as suspended solids.

12) Evaluate impacts of nonpoint source wasteloads on a basis other than the effects on water quality. Emphasis should be directed toward erosion, flood control, transportation, air quality, etc. The results will be used to interface with other environmental programs as required by 208.

13) Monitor and analyze all existing nonpoint source controls in the Armand Bayou area. Emphasis should be on cataloguing controls and evaluating performance in order to develop data base for a refined nonpoint source control program throughout the area.

14) Inventory and map all existing water districts and service areas in the segment. This effort will be part of the updated data base for ongoing planning.

15) Coordinate 208 plans and implementations with other environmental programs including air quality, transportation, solid waste, 201, 303, coastal management, and parks/recreation projects.

Phasing and Costs

Population and land use projections, along with existing 201 plans, were utilized as the basis for projecting the future wastewater treatment and conveyance system facility needs in Armand Bayou. Table IV-4 presents the phasing for three distinct time periods, for municipal facilities on a geographical planning area basis. Table IV-5 presents the associated cost estimates, both capital and operational and maintenance, for the projected facilities, also on a geographical planning area basis.

In Armand Bayou, the projected new facilities for the 1977-1983 time period include:

1) Upgrading of one treatment plant from level 2 to level 3NP.

2) New collection facilities capable of serving an additional 11,660 persons.

Projected facilities for the 1984-1990 time period include additional collection systems serving 9,630 persons. In the final time period, 1991-1995, additional collection facilities are projected for 6,880 persons.

The associated estimated costs for capital expenses and annual operational and maintenance expenses are summarized in Table IV-8. Also included in the Table is an estimate for the total cost per 1,000 gallons for wastewater treatment based on average daily dry weather flow during the time period.

TABLE IV-8

SUMMARY OF ESTIMATED COSTS*
ARMAND BAYOU

Period	Capital Cost (Total)	O & M Cost (Annual Avg.)	Total Cost ($/1000 Gallons)
1977 - 1983	3,240,000	649,000	0.78
1984 - 1990	2,120,000	658,000	0.78
1991 - 1995	1,510,000	669,000	0.73

* Costs based on 1975 dollars.

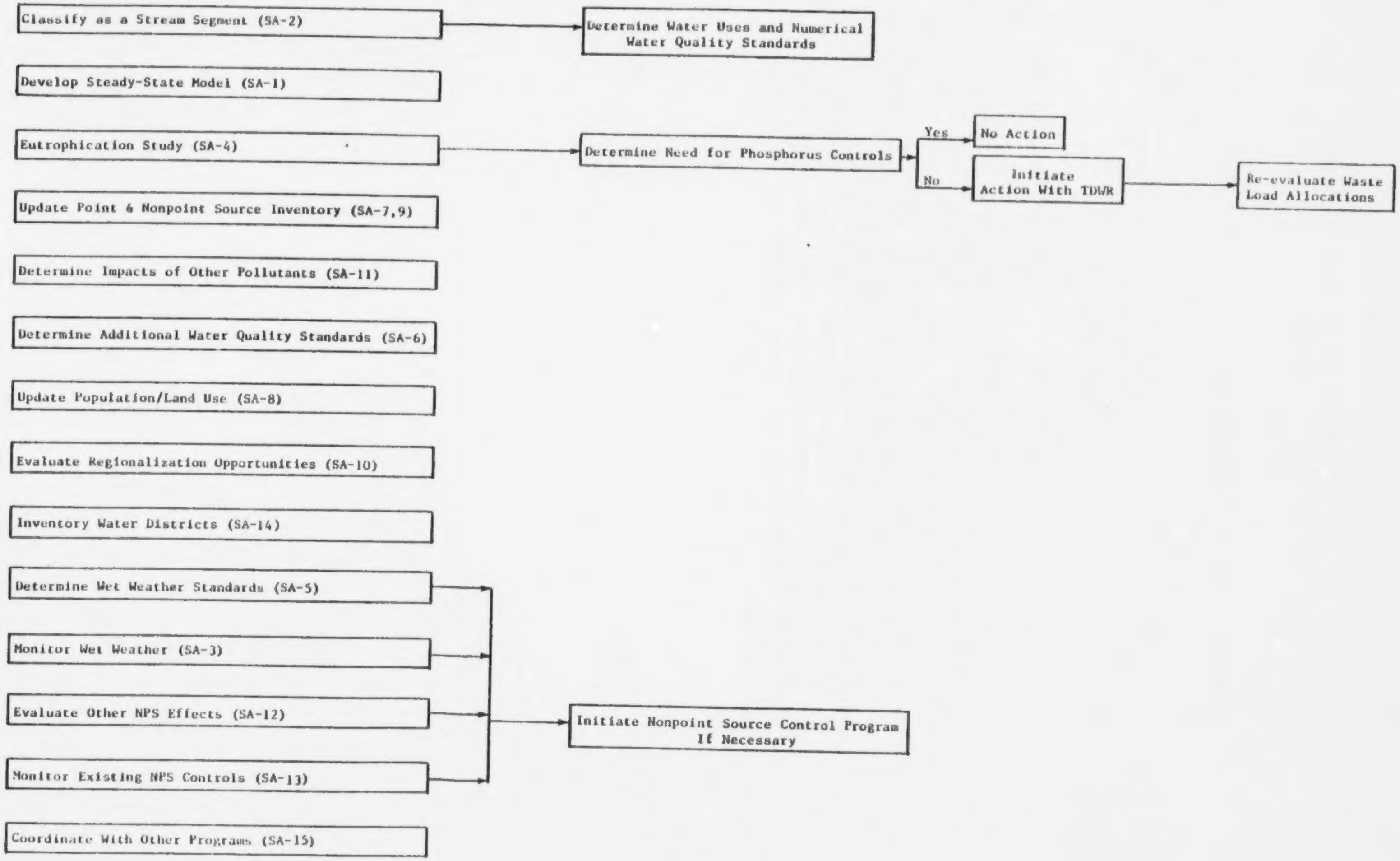
Action Check List

Items required to implement the 208 plan in Armand Bayou have been identified in this Chapter. Figure IV-4 presents the relationship between these items and other ongoing planning activites. Special activities (SA) identified in the flow chart refer to those previously described. Priorities for these special activities were presented in Chapter II.

FIGURE IV-4

INTERRELATIONSHIP OF IMPLEMENTATION REQUIREMENTS

ARMAND BAYOU


Classify as a Stream Segment (SA-2)
Determine Water Uses and Numerical Water Quality Standards
Develop Steady-State Model (SA-1)
Eutrophication Study (SA-4)
Determine Need for Phosphorus Controls
Yes
No Action
No
Initiate Action With TDWR
Re-evaluate Waste Load Allocations
Update Point & Nonpoint Source Inventory (SA-7,9)
Determine Impacts of Other Pollutants (SA-11)
Determine Additional Water Quality Standards (SA-6)
Update Population/Land Use (SA-8)
Evaluate Regionalization Opportunities (SA-10)
Inventory Water Districts (SA-14)
Determine Wet Weather Standards (SA-5)
Monitor Wet Weather (SA-3)
Evaluate Other NPS Effects (SA-12)
Monitor Existing NPS Controls (SA-13)
Initiate Nonpoint Source Control Program If Necessary
Coordinate With Other Programs (SA-15)

Dickinson Bayou (Segments 1103 & 1104)

Technical Subplan

Point Sources. The technical subplan for point source discharges includes the following:

1) Operate existing and future wastewater treatment facilities at current permit level pending results of further modeling effort.

2) Consider adopting an effluent standard of 8.0 mg/l of NH_3-N for use in permits where more restrictive levels do not apply.

3) Consider maximum limits on chlorine residual in treatment plant effluent.

4) Consider elimination of the phosphorus requirements where applicable based on the results of the recommended eutrophication study.

5) Construct future facilities with flexibility to be upgraded to meet a level of treatment as restrictive as effluent set 3NP.

Nonpoint Sources. Nonpoint source wasteloads are not projected to be of major concern relative to fishable/swimmable criteria during wet weather conditions. This conclusion is based on limited data. Additionally, wet weather water quality simulation modeling was not performed for the bayou. Therefore, further monitoring is recommended to verify the conclusions.

Nonpoint source wasteloads were identified as a contributing factor to the total phosphorus loading into Dickinson Bayou. Additional nonpoint sources of phosphorus from tidal influence were not identified but are potentially significant.

The 208 plan recommends the encouragement of best management practices to reduce the amount of nonpoint source pollutant runoff into Dickinson Bayou. Additionally, a study to identify the sources and total loadings of phosphorus entering Dickinson Bayou is recommended.

Other. Additional items included as part of the Dickinson Bayou technical subplan are:

1) Develop a calibrated and verified steady-state water quality simulation model to include both the tidal and nontidal segments.

2) Implement field monitoring to verify the conclusions of wet weather and dry weather water quality.

3) Formulate wet weather water quality standards consistent with dry weather water uses.

Impact on Regulatory Functions

Permitting. The 208 program recommends that the existing level of permitted discharge into Dickinson Bayou be continued. The general level of discharge in the tidal segment is effluent set 2P (BOD=10 mg/1, TSS=15 mg/1, and P=2 mg/1). In the nontidal segment effluent set 1 is permitted (BOD=20 mg/1 and TSS=20 mg/1).

Results of the 208 program indicate that the existing levels of permitted treatment may not be sufficient to achieve fishable/swimmable water quality criteria throughout the basin. However, these conclusions are based on the results of nonspecific, uncalibrated and unverified water quality simulation models. Therefore, recommendations for more restrictive permit conditions can not be definitively stated until further studies, including verified simulation modeling, are concluded. The plan does recommend that new discharge permits be issued with the provision for design flexibility for upgrading to a level of treatment as restrictive as effluent set 3N in the tidal segment and effluent set 2 in the nontidal segment.

Other impacts on permitting in the Dickinson Bayou drainage basin relate to new parameters mentioned for possible control. These include ammonia-nitrogen and chlorine residual. The recommendation for adopting an ammonia-nitrogen standard of 8.0 mg/1 where more restrictive levels do not apply has been further defined in the section pertaining to special programs in Chapter II.

Permits for maximum chlorine residuals should be considered in order to protect Dickinson Bayou and its aquatic environment from the possibly toxic effects of excessive chlorine and the formation of chlorinated hydrocarbons.

An additional impact on permitting will occur if the results of the recommended eutrophication study on the Dickinson Bayou drainage basin, including tidal contributions, indicate that the phosphorus removal requirement is not cost effective.

Monitoring. Monitoring efforts in Dickinson Bayou will continue to assess the segment water quality and the effluent quality through the existing mechanisms. Additional monitoring in the area should be dictated by ongoing planning requirements and implementation needs. These items include:

1) Monitoring of dry weather water quality to develop a data base for verification of future modeling efforts.

2) Monitoring of wet weather water quality for verification of assumptions and development of a data base.

3) Identification of sources and total loadings of phosphorus to the segments.

4) Updating of baseline information such as population/land use projections etc.

Standards. Dry weather standards for water quality in Dickinson Bayou are presently recommended to be consistent with fishable/swimmable water quality criteria for the 208 area (i.e. D.O. $\geq$ 5.0 mg/1 and fecal coliform less than 200 MPN/100 ml).

As previously noted, upgrading of existing permit conditions may be required to achieve this criteria. Once a calibrated and verified model is developed for Dickinson Bayou, a re-evaluation of the obtainable water quality can be made and a more authoritative recommendation for dry weather water quality standards can be determined.

Wet weather water quality standards have not yet been defined for the area. However, a special program has been defined as the basis for developing the wet weather water quality criteria, including parameters and numerical values, consistent with dry weather water uses.

Allocations. The 208 plan recommends that the existing wasteload allocations, developed by TDWR, be continued in Dickinson Bayou for the present. However, technical subplanning efforts indicate that existing allocations combined with the defined nonpoint source wasteloads may exceed the assimilative capacity of the bayou to maintain the existing criteria for fishable/swimmable water quality. Based on the results of on-going planning and recommended studies, it appears that wasteload allocations may require redefinition by the TDWR. Dickinson Bayou has been classified by the TDWR as Water Quality (WQ) Limited.

Special Activities Required to Implement

A complete list of the continuing planning and special programs included as part of the 208 recommendations was presented in Chapter II. Programs specific to Dickinson Bayou are summarized below. A complete description of the program is contained in the Appendix.

1) Develop calibrated and verified steady-state water quality simulation model. Special emphasis should be directed toward ammonia-nitrogen degredation and deoxygenation rates.

2) Monitor wet weather water quality in order to verify existing assumptions.

3) Initiate eutrophication study in Dickinson Bayou drainage basin. Emphasis should be on total phosphorus loadings and sources including tidal contributions. Results will be utilized to evaluate the cost effectiveness of point source phosphorus controls.

4) Determine wet weather water quality standards. Parameters and numerical values should be consistent with fishable/swimmable water uses.

5) Determine maximum chlorine residuals which will be consistent with fishable/swimmable conditions; consider modifying permits accordingly.

6) Update the point source inventory in the segment. Emphasis should be directed toward maintaining accurate and up-to-date information that is easily updated. This will provide input to future planning efforts.

7) Update the population and land use data. Emphasis should be on computerization of data base to allow greatest flexibility of the data. Applications of this activity include re-evaluation of allocations, nonpoint source wasteload evaluation, problem area prediction, etc.

8) Update nonpoint source wasteload identification and projections. Emphasis should be directed toward dry weather contributions in the segment.

9) Evaluate regionalization opportunities in the segment. Emphasis should be on coordination of the 201 program and evaluation of planning areas during the pre-grant application phase.

10) Determine impacts of other pollutants on Dickinson Bayou water quality. Emphasis should be on heavy metals and toxic materials as well as suspended solids.

11) Evaluate impacts of nonpoint source wasteloads on a basis other than the effects on water quality. Emphasis should be directed toward erosion, flood control, transportation, air quality, etc. The results will be used to interface with other environmental programs as required by 208.

12) Coordinate the nondesignated area 208 plan with the designated area 208 plan in order to efficiently implement the recommendations.

13) Monitor and analyze all existing nonpoint source controls in the Dickinson Bayou area. Emphasis should be on cataloguing controls and evaluating performance in order to develop data base for a refined nonpoint source control program throughout the area.

14) Inventory and map all existing water districts and service areas in the segment. This effort will be part of the updated data base for ongoing planning.

15) Coordinate 208 plans and implementations with other environmental programs including air quality, transportation, solid waste, 201, 303, coastal management, and parks/recreation projects.

Phasing and Costs

Population and land use projections along with existing 201 plans were utilized as the basis for projecting the future wastewater treatment and conveyance system facility needs in the Dickinson Bayou segment. Table IV-4 presents the phasing for three distinct time periods, for municipal facilities broken down by geographical planning area. Table IV-5 presents the associated cost estimates both capital and operational and maintenance, for the projected facilities.

In the Dickinson Bayou segment, the projected new facility construction for the 1977-1983 time period includes:

1) Upgrade three existing treatment plants from effluent set 2 to effluent set 2P.

2) Additional collection facilities serving 5,070 persons.

Projected facilities for the 1984-1990 time period include additional collection systems serving 2,090 persons. In the final time period 1991-1995 additional collection facilities are projected for 2,240 persons.

It should be noted that if the recommended modeling effort concurs with the existing prediction, that requiring upgrading of treatment level to maintain fishable/swimmable water quality, the required upgrading will occur in the 1984-1990 time period.

The associated estimated costs for capital expenses and operational and maintenance expenses are summarized in Table IV-9. Also included in the Table is an estimate for total cost per 1,000 gallons for treatment of wastewater based on the average daily dry weather flow during the time period.

TABLE IV-9

SUMMARY OF ESTIMATED COSTS*
DICKINSON BAYOU

Period	Capital Cost (Total)	O & M Cost (Annual Avg.)	Total Cost ($/1,000 Gallons)
1977 - 1983	2,140,000	549,000	0.58
1984 - 1990	461,000	552,000	0.59
1991 - 1995	493,000	554,000	0.59

* Costs based on 1975 dollars.

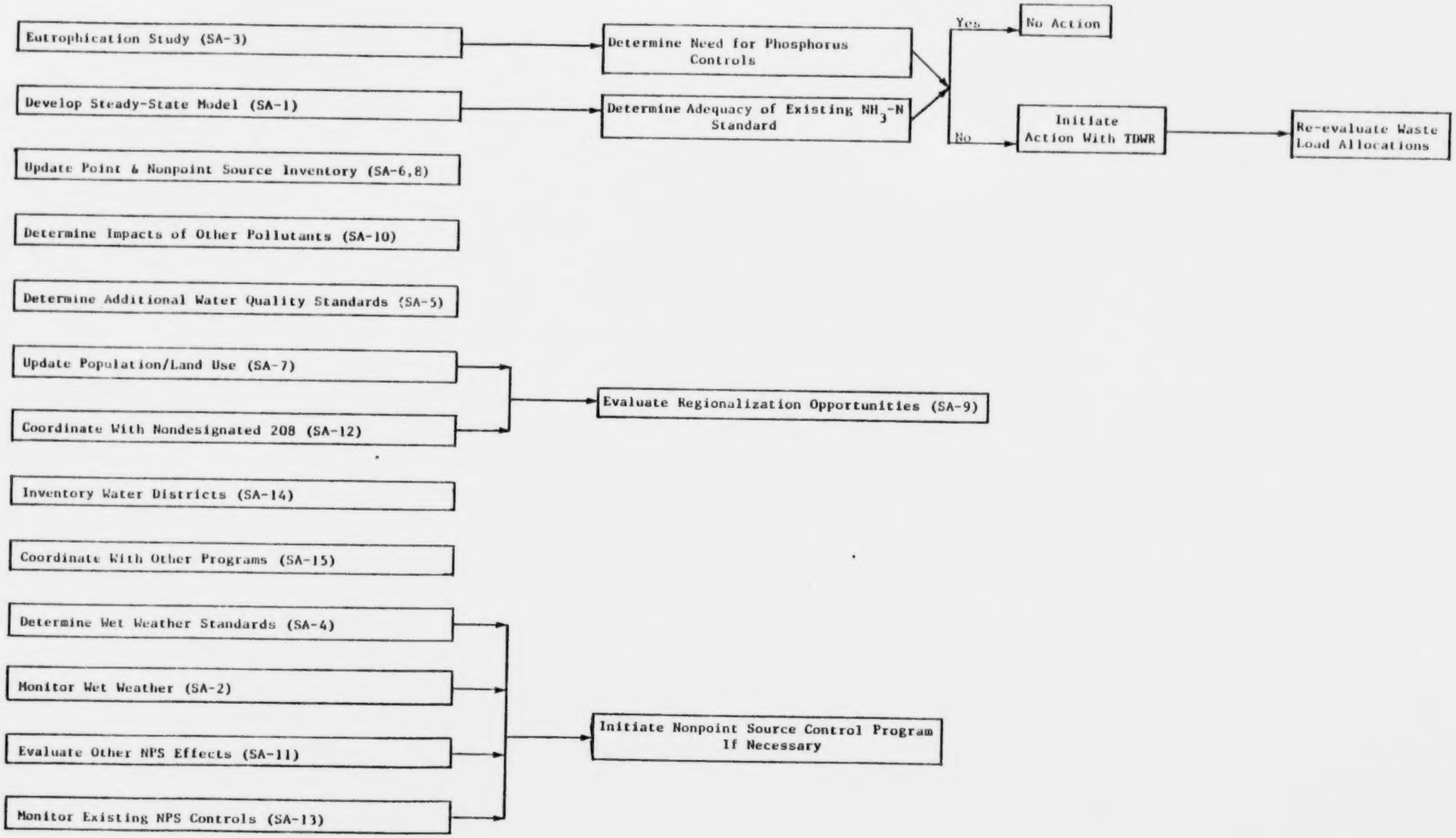
Action Check List

Items required to implement the 208 plan in Dickinson Bayou have been identified in this chapter. Figure IV-5 presents the relationships between these items and other ongoing planning activities. Special activities (SA) identified in the flow chart refer to those previously described. Priorities for these special activities were presented in Chapter II.

FIGURE IV-5

INTERRELATIONSHIP OF IMPLEMENTATION REQUIREMENTS

DICKINSON BAYOU


Eutrophication Study (SA-3)
Develop Steady-State Model (SA-1)
Update Point & Nonpoint Source Inventory (SA-6,8)
Determine Impacts of Other Pollutants (SA-10)
Determine Additional Water Quality Standards (SA-5)
Update Population/Land Use (SA-7)
Coordinate With Nondesignated 208 (SA-12)
Inventory Water Districts (SA-14)
Coordinate With Other Programs (SA-15)
Determine Wet Weather Standards (SA-4)
Monitor Wet Weather (SA-2)
Evaluate Other NPS Effects (SA-11)
Monitor Existing NPS Controls (SA-13)
Determine Need for Phosphorus Controls
Determine Adequacy of Existing NH3-N Standard
Yes
No
No Action
Initiate Action With TDWR
Re-evaluate Waste Load Allocations
Evaluate Regionalization Opportunities (SA-9)
Initiate Nonpoint Source Control Program If Necessary

CHAPTER V HOUSTON SHIP CHANNEL SUBBASIN

CHAPTER V HOUSTON SHIP CHANNEL SUBBASIN

Introduction

The Houston Ship Channel subbasin consists of the entire Ship Channel and its side bays (Tabbs, San Jacinto, Black Duck, Scott, Burnett), the lower San Jacinto River and tributaries to the Ship Channel. The major tributaries include Buffalo, White Oak, Brays, Sims, Vince, Hunting, Greens/Halls, and Carpenters Bayous.

Houston Ship Channel
(Segments 1005-1007, 2426-2430)

Technical Subplan

Point Sources. The steady-state water quality simulation model, utilized to predict water quality within the Houston Ship Channel, and side bays indicates that wastewater treatment plants discharging directly into the Ship Channel have little impact on the overall water quality. The major source of wasteload impacting Ship Channel quality originates in the tributary bayous.

The technical subplan for point source discharges includes the following:

1) Operate existing and future municipal wastewater treatment systems at the existing permit conditions.

2) Consider increasing wasteload allocations in the lower Houston Ship Channel.

3) Operate existing and future industrial wastewater treatment facilities at federally-mandated standards.

Nonpoint Sources. Nonpoint source wasteloads are predicted to be a major contribution to the overall pollutant loading into the Ship Channel. Dry weather nonpoint sources such as benthal oxygen demand appear to be very significant in the area of the Turning Basin. The 208 plan recommends re-verification of the benthal oxygen demand along with other parameters in the steady-state model.

Wet weather modeling efforts indicate that nonpoint source runoff dominates water quality during wet weather conditions. The model predicts that fishable/swimmable water quality cannot be maintained in the Houston Ship Channel due to these loadings. On the other hand, the number of reported fish kills are lower than calculations of present water quality would indicate, therefore, the 208 plan recommends verification of wet weather quality as an initial phase of implementing the technical subplan.

Other. Additional recommendations for the Houston Ship Channel subbasin include:

1) Re-verification of the steady-state model. Special emphasis should be directed to nitrogenous and benthal oxygen demands.

2) Expand dry weather model to include all tributaries receiving major wasteloads.

3) Evaluate instream aeration as a technique for increasing assimilative capacity.

4) Implement wet weather monitoring program to verify the conclusions of the wet weather model.

5) Formulate wet weather water quality standards consistent with dry weather uses.

Impact on Regulatory Function

Permitting. The 208 program recommends that the existing level of permitted discharge into the Houston Ship Channel be continued. The general level of municipal treatment along the Channel is effluent set 2. Therefore, no major impacts on the permitting function are anticipated at this time.

Monitoring. Monitoring efforts in the Houston Ship Channel are recommended by the 208 plan to be greatly expanded. Existing mechanisms will continue to assess the segment water quality and effluent quality. Additional monitoring efforts will be directed toward verification of the data base and existing assumptions or as dictated by the ongoing planning requirements.

The major impact on monitoring will be the emphasis on wet weather water quality. The objective will be to define a realistic and year around obtainable water quality in the Houston Ship Channel. Present indications are that wet weather water quality will be the limiting factor in any future criteria.

Stream Standards. Under PL 92-500, dry weather standards for water quality in the upper portion of the Houston Ship Channel would have to be upgraded to be consistent with fishable/swimmable criteria. However, technical efforts indicate that the upper Ship Channel will not be capable of meeting this criteria without supplemental aeration. The wasteloads creating the high oxygen demand originate in unmodeled tributaries of the Ship Channel as previously discussed.

Side bays and the lower portion of the Channel are projected to meet fishable/swimmable quality during dry weather in accordance with existing standards.

Wet weather water quality standards have not been defined for the Houston Ship Channel. Technical subplanning efforts indicate that storm water related wasteloads totally dominate the Ship Channel during and following wet weather conditions for periods in excess of 10 days. Since it would be economically unrealistic to control these nonpoint source wasteloads, water quality standards for dry and wet weather may have to be established below fishable/swimmable criteria.

The 208 plan recommends that wet weather monitoring be implemented to verify the existing conclusion of wet weather water quality. If wet weather monitoring does not verify the preliminary conclusions, the TDWR is recommended to develop a verified storm water model (both inputs and response) to more accurately predict obtainable water quality. Then dry weather standards should be reviewed for conformance with realistic goals.

Allocations. The 208 plan recommends that all existing wasteload allocations, developed by the TDWR, be continued in the Houston Ship Channel segments for the present time. Technical subplan efforts indicate that excess assimilative capacity exists in the Houston Ship Channel below the San Jacinto river. Technical efforts also indicate that additional wasteload capacity can be developed through supplemental instream aeration.

Based on future considerations, verification monitoring, and the results of ongoing planning described elsewhere in this Chapter, it appears that the wasteload allocations for the Houston Ship Channel may require redefinition by the TDWR. If increased wasteload allocations are recommended, special emphasis should be directed toward industrial utilization of the excess capacity. Both new and existing industry should be considered.

All segments and side bays along the Houston Ship Channel (except Black Duck Bay) have been classified by the TDWR as Water Quality (WQ) Limited.

Special Activities Required to Implement

A complete list of the continuing planning and special programs included as part of the 208 plan recommendations was presented in Chapter II. Programs specific to the Houston Ship Channel subbasin are summarized below. A complete description of the program is contained in the Appendix.

1) Update steady-state water quality simulation model. Emphasis should include, a) extending the model to include major tributaries, b) benthal oxygen demand, c) nitrification, d) re-verification of rate constants.

2) Monitor wet weather water quality. Emphasis should be on determining a realistic water quality criteria if results show that wet weather conditions dominate.

3) Update nonsteady-state water quality simulation model if wet weather monitoring indicates Ship Channel Water quality is not dominated by storm related wasteloads. Emphasis should be on targeting wasteload reductions and meeting realistic water quality standards.

4) Evaluate alternate dry weather water quality standards and uses based on results of wet weather monitoring program.

5) Determine wet weather water quality standards. Parameters and numerical values should be consistent with dry weather standards and uses.

6) Evaluate supplemental aeration. Emphasis should be on effects and cost effectiveness in relation to D.O. levels. Applications are, a) alternative method of achieving standards, and b) method of increasing wasteload allocations.

7) Update the point source inventory. Emphasis should be directed toward maintaining accurate and up-to-date information that is easily updated. This will provide input to future planning efforts.

8) Update the population and land use data. Emphasis should be on computerization of data base to allow greatest flexibility of the data. Applications of this activity include re-evaluation of allocations, nonpoint source wasteload evaluation, problem area prediction, etc.

9) Update nonpoint source wasteload identification and projections. Emphasis should be directed toward wet weather contributions. Information developed should be incorporated into the existing nonsteady-state model where applicable.

10) Evaluate regionalization opportunities. Emphasis should be on coordination of the 201 program and evaluation of planning areas during the pre-grant application phase.

11) Determine impacts of other pollutants on Houston Ship Channel water quality. Emphasis should be on heavy metals and toxic materials as well as suspended solids.

12) Evaluate impacts of nonpoint source wasteloads on a basis other than the effects on water quality. Emphasis should be directed toward erosion, flood control, transportation, air quality, etc. The results will be used to interface with other environmental programs as required by 208.

13) Coordinate the nondesignated area 208 plan with the designated area 208 plan in order to efficiently implement the recommendations.

14) Monitor and analyze all existing nonpoint source controls in the Houston Ship Channel area. Emphasis should be on cataloguing controls and evaluating performance in order to develop data base for a refined nonpoint source control program throughout the area.

15) Inventory and map all existing water districts and service areas. This effort will be part of the updated data base for ongoing planning.

16) Coordinate 208 plans and implementations with other environmental programs including air quality, transportation, solid waste, 201, 303, coastal management, and parks/recreation projects.

Phasing and Costs

Population and land use projections along with existing 201 plans were utilized as the basis for projecting the future wastewater treatment and conveyance system facility needs in the Houston Ship Channel segments. Table V-1 presents the phasing for three distinct time periods, for new municipal facilities, broken down by geographical planning areas. (A description and maps of geographical planning areas is included in the Alternative Technical Subplans report). Table V-2 presents the associated cost estimates, both capital and operational and maintenance, for the projected facilities, also on a geographical planning area basis.

Along the Houston Ship Channel, projected new municipal wastewater treatment facilities for construction in the 1977-1983 time period include:

1) One treatment plant expansion increasing capacity by 0.5 MGD.

2) New collection facilities serving an additional 18,900 persons.

Facilities projected for the 1984-1990 time period include:

1) Three plant expansions increasing treatment capacity by 2.0 MGD.

2) New collection facilities serving an additional 16,600 persons.

During the final time period, 1991-1995, additional collection facilities serving 11,800 person are projected.

The associated estimated costs for capital expenses and annual operational and maintenance expenses are summarized in Table V-3. Also included in the Table is the estimated total cost per 1000 gallons for treatment of wastewater based on average daily dry weather flow during the period.

TABLE V-1
HOUSTON SHIP CHANNEL
SCHEDULE OF PROJECTED CONSTRUCTION NEEDS
MUNICIPAL WASTEWATER TREATMENT ONLY

Geographical Planning Area	Plant Or Service Area	Existing Capacity Treatment Level	Projected Construction Needs			Estimated Dry Weather Flow/ Total Capacity Available (MGD)				Comments
			1977-1983	1984-1990	1991-1995	1977	1983	1990	1995	
HSC-1	Galena Park	0.75/2	Collect - 300	Collect - 200	Collect - 200	0.28/0.75	0.34/0.75	0.41/0.75	0.46/0.75	Industrial sources at federally mandated standards.
	Clinton Park	0.75/2	Collect - 800	Expand to 1.1/2 Collect - 700	Collect - 500	0.54/0.75	0.72/0.75	0.94/1.1	1.1/1.1	
HSC-2	WCID 21	0.85/2	Collect - 200	Collect - 200	Collect - 100	0.76/0.85	0.8/0.85	0.85/0.85	0.88/0.85	
HSC-3	Deer Park	3.0/2	Collect - 3200	Expand to 4.1/2 Collect - 2800	Collect - 2100	2.2/3.0	3.0/3.0	3.6/4.1	4.1/4.1	
	Pasadena Deepwater	4.0/2	Collect - 2700	Collect - 2300	Collect - 1700	2.3/4.0	2.7/4.0	3.2/4.0	3.5/4.0	
	Pasadena Golden Acres	5.0/2	Collect - 6200	Collect - 5400	Collect - 3800	1.5/5.0	2.0/5.0	2.6/5.0	3.0/5.0	
HSC-4	Baytown Central	4.7/2	Collect - 4400	Expand to 5.25/5 Collect - 3900	Collect - 2700	3.7/4.7	4.2/4.7	4.8/5.25	5.25/5.25	
	FWSD 1A	0.45/2	-	-	-	0.2/0.45	0.2/0.45	0.21/0.45	0.21/0.45	
HSC-5	Morgans Point	0.1/2	Expand to 0.6/2	Collect - 100	-	0.12/0.1	0.27/0.6	0.46/0.6	0.6/0.6	
					Total Flow/Capacity	11.6/19.6	14.2/20.1	17.1/22.1	19.1/22.1	

Notes: 1) Existing Capacity/Treatment Level based on information provided by the municipal inventory (Activity 3) or Facility Plans.

2) See Table V-2 for costs.

TABLE V-2
HOUSTON SHIP CHANNEL BASIN
ESTIMATED COSTS OF WASTEWATER TREATMENT
MUNICIPAL WASTEWATER TREATMENT ONLY

Geographical Planning Area	Plant or Service Area	Estimated Capital Costs						Estimated Annual Operation and Maintenance Costs						Comments
		1977-1983		1984-1990		1991-1995		1977-1983		1984-1990		1991-1995		
		Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	
HSC-1	Galena Park	0	66,000	0	44,000	0	44,000	74,000	14,000	74,000	15,000	74,000	15,000	
	Clinton Park	0	176,000	648,000	154,000	0	110,000	74,000	18,000	86,000	19,000	86,000	20,000	
HSC-2	WCID 21	0	44,000	0	44,000	0	22,000	77,000	15,000	77,000	15,000	77,000	15,000	
HSC-3	Deer Park	0	704,000	1,128,000	616,000	0	462,000	148,000	42,000	173,000	46,000	173,000	49,000	
	Pasadena Deepwater	0	594,000	0	506,000	0	264,000	173,000	38,000	173,000	42,000	173,000	44,000	
	Pasadena Golden Acres	0	1,364,000	0	1,188,000	0	836,000	199,000	27,000	199,000	35,000	199,000	40,000	
HSC-4	Baytown Central	0	97,000	804,000	858,000	0	594,000	191,000	56,000	205,000	62,000	205,000	66,000	
	FWSD 1A	0	0	0	0	0	0	62,000	1,000	62,000	1,000	62,000	1,000	
HSC-5	Morgans Point	768,000	0	0	22,000	0	0	68,000	1,000	68,000	1,000	68,000	1,000	
	Subtotal	768,000	3,045,000	2,580,000	3,432,000	0	2,332,000	1,066,00	212,000	1,117,000	236,000	1,117,000	248,000	
	Total by Period	3,813,000		6,012,000		2,332,000		1,278,000		1,353,000		1,365,000		
							Amortized Capital Cost	315,000		812,000		1,004,000		
							Total Annual Cost	1,593,000		2,165,000		2,369,000		
							Cost/1000 gal	$.34		$.38		$.36		

Notes:
1) See Table V-1 for construction actions required.
2) Capital costs amortized at 7¼% over 30 years.
3) Costs based on 1975 dollars.

TABLE V-3

SUMMARY OF ESTIMATED COSTS*
HOUSTON SHIP CHANNEL

Period	Capital Cost (Total)	O & M Cost (Annual Avg.)	Total Cost ($/1,000 Gallons)
1977 - 1983	3,810,000	1,280,000	0.34
1984 - 1990	6,010,000	1,350,000	0.38
1991 - 1995	2,330,000	1,370,000	0.36

* Costs based on 1975 dollars. Municipal wastewater treatment only.

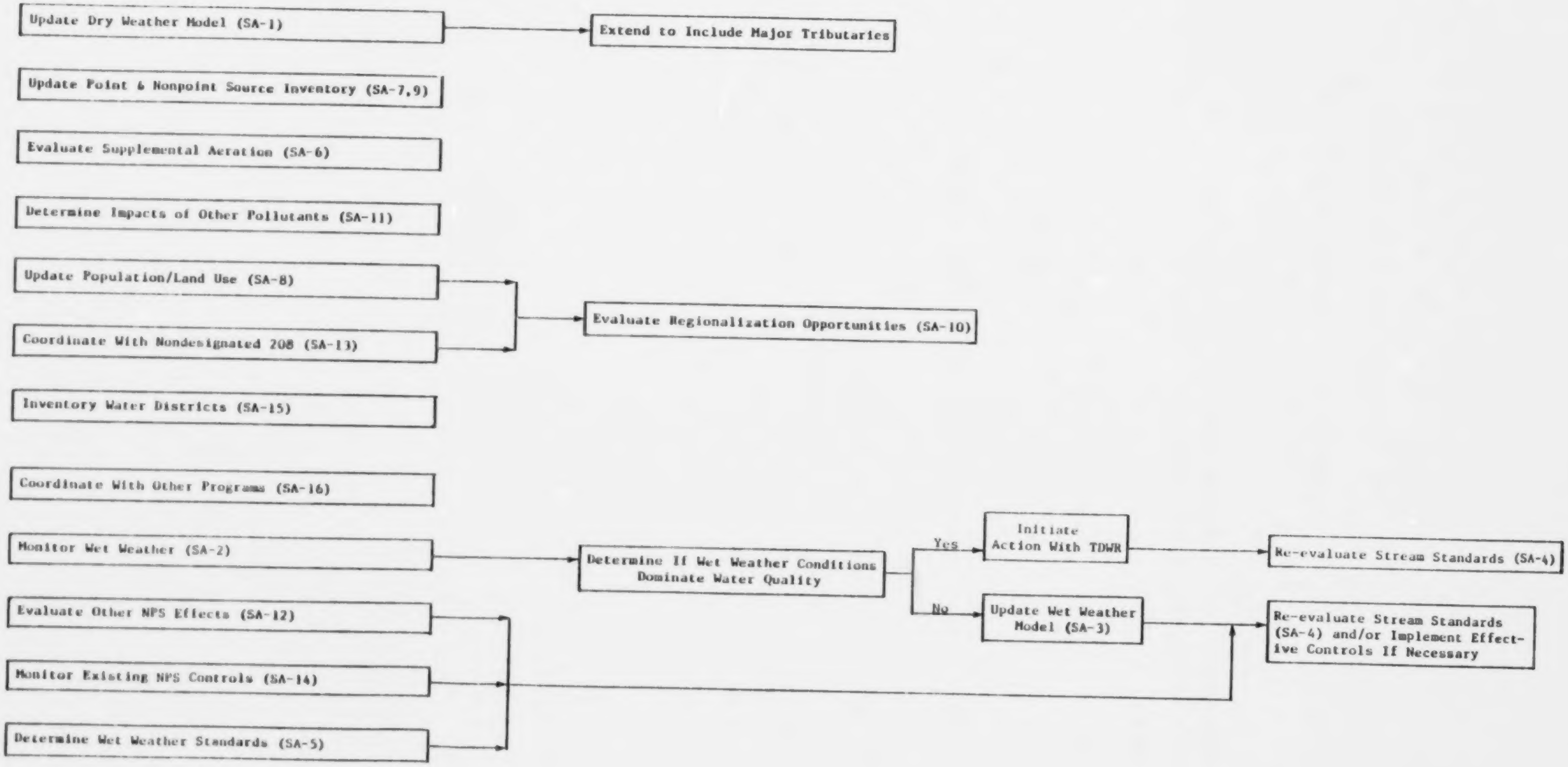
Action Check List

Items required to implement the 208 plan in the Houston Ship Channel have been identified in this chapter. Figure V-1 presents the interrelationships between activities, decisions, and ongoing planning efforts. Special activities (SA) identified in the figure refer to those previously described. Priorities and further definition for the special activities were presented in Chapter II.

FIGURE V-1

INTERRELATIONSHIP OF IMPLEMENTATION REQUIREMENTS

HOUSTON SHIP CHANNEL


Update Dry Weather Model (SA-1)
Extend to Include Major Tributaries
Update Point & Nonpoint Source Inventory (SA-7,9)
Evaluate Supplemental Aeration (SA-6)
Determine Impacts of Other Pollutants (SA-11)
Update Population/Land Use (SA-8)
Coordinate With Nondesignated 208 (SA-13)
Evaluate Regionalization Opportunities (SA-10)
Inventory Water Districts (SA-15)
Coordinate With Other Programs (SA-16)
Monitor Wet Weather (SA-2)
Determine If Wet Weather Conditions Dominate Water Quality
Yes
Initiate Action With TDWR
Re-evaluate Stream Standards (SA-4)
No
Update Wet Weather Model (SA-3)
Re-evaluate Stream Standards (SA-4) and/or Implement Effective Controls If Necessary
Evaluate Other NPS Effects (SA-12)
Monitor Existing NPS Controls (SA-14)
Determine Wet Weather Standards (SA-5)

San Jacinto River Tidal (Segment 1001)

Technical Subplan

Point Sources. The technical subplan for point source discharges includes:

1) Operate existing and future municipal treatment plants at the existing permitted discharge level.

2) Consider adopting 8.0 mg/l standard for ammonia-nitrogen where more restrictive levels do not apply.

Nonpoint Sources. Dry weather nonpoint sources, except for dredging related wasteloads, are not projected to present a major problem in the San Jacinto River Tidal basin. The technical subplan recommends that dredging activities be prohibited during dry weather, low flow conditions.

Stormwater related nonpoint source wasteloads are projected to create water quality problems in the lower San Jacinto. This conclusion is based on results of the unverified stormwater model. Technical work indicates that the major wasteloads entering the San Jacinto River originate in the Houston Ship Channel. Therefore specific controls on stormwater related wasteloads are not expected to be effective.

Other. Additional recommendations for the San Jacinto River sub-basin include:

1) Initiate a wet weather monitoring program to verify the modeling predictions.

2) Formulate wet weather water quality standards consistent with dry weather water uses.

3) Update steady-state water quality model. Emphasis should be on rate constants and definition of benthic demand.

Impact on Regulatory Function

Permitting. The 208 plan recommends that the existing level of permitted discharge into the San Jacinto River be continued. The general level throughout the segment is effluent set 1 (BOD=20 mg/l and TSS=20 mg/l).

The only impact on permitting may result from the recommendation to consider limits on ammonia-nitrogen. Based on the results of the recommended model verification study, the TDWR may have to re-evaluate discharge permits.

Monitoring. Monitoring efforts in the Lower San Jacinto River subbasin will continue to assess the segment water quality and the effluent quality through the existing mechanisms. Additional monitoring activities should be directed toward verification of the data base and existing assumptions or as indicated by the ongoing planning requirements.

The major impact on monitoring will be the emphasis on wet weather water quality and the relationship between the San Jacinto River and the Houston Ship Channel.

Stream Standards. The 208 plan recommends that dry weather water quality be consistent with fishable/swimmable water quality parameters for the 208 area (i.e. D.O. $\geq$ 5.0 mg/l and fecal coliform less than 200 MPN/100 ml). Wet weather standards have not been defined for the San Jacinto River. However, the 208 plan recommends that parameters and numerical values consistent with dry weather water uses be defined. This is further discussed in the section on special studies.

Allocations. The 208 plan recommends that the existing wasteload allocations, developed by the TDWR, be continued in the segment. Based on existing data, no major impacts are expected on this regulatory function. This segment has been classified by the TDWR as Water Quality (WQ) Limited.

Special Activities Required to Implement

A complete list of the continuing planning and special programs included as part of the 208 recommendations was presented in Chapter II. Programs specific to the San Jacinto River are summarized below. A complete description of the program is contained in the Appendix.

1) Update steady-state water quality simulation model. Emphasis should be on verification of rate constants, benthic demand, nitrification effects and on relationship to Houston Ship Channel.

2) Initiate wet weather water quality monitoring program. Emphasis should be on verification of existing modeling predictions.

3) Update nonsteady-state water quality simulation model as described in Houston Ship Channel section.

4) Determine wet weather water quality standards. Parameters and numerical values should be consistent with dry weather uses.

5) Update the point source inventory in the segment. Emphasis should be directed toward maintaining accurate and up-to-date information that is easily updated. This will provide input to future planning efforts.

6) Update the population and land use data. Emphasis should be on computerization of data base to allow greatest flexibility of the data. Applications of this activity include re-evaluation of allocations, nonpoint source wasteload evaluation, problem area prediction, etc.

7) Update nonpoint source wasteload identification and projections. Emphasis should be directed toward dry weather contributions. Information developed should be incorporated into the existing steady-state model where applicable.

8) Determine impacts of other pollutants on the San Jacinto River water quality. Emphasis should be on heavy metals and toxic materials as well as suspended solids.

9) Evaluate impacts of nonpoint source wasteloads on a basis other than the effects on water quality. Emphasis should be directed toward erosion, flood control, transportation, air quality, etc. The results will be used to interface with other environmental programs as required by 208.

10) Coordinate the nondesignated area 208 plan with the designated area 208 plan in order to efficiently implement the recommendations.

11) Monitor and analyze all existing nonpoint source controls in the San Jacinto River Tidal area. Emphasis should be on cataloguing controls and evaluating performance in order to develop data base for a refined nonpoint source control program throughout the area.

12) Inventory and map all existing water districts and service areas in the segment. This effort will be part of the updated data base for ongoing planning.

13) Coordinate 208 plans and implementations with other environmental programs including air quality, transportation, solid waste, 201, 303, coastal management, and parks/recreation projects.

Phasing and Costs

Population and land use projections were utilized along with existing 201 plans as the basis for projecting the future wastewater treatment and conveyance system facility needs in the San Jacinto River Tidal basin. Table V-4 presents the phasing for three distinct time periods, for new municipal facilities, broken down by geographical planning areas. Table V-5 presents the associated cost estimates, both capital and operations and maintenance, for the projected facilities.

In the San Jacinto River Tidal basin, the projected new facilities for the 1977-1983 time period include:

1) One new plant with a capacity of 1.3 MGD.

2) Two plant expansions increasing capacity by approximately 0.17 MGD.

3) New collection facilities capable of serving an additional 4,760 persons.

In the 1984-1990 time period, new collection facilities for an additional 4,310 persons are projected.

In the final time period, 1991-1995, additional collection systems capable of serving 3,040 persons are projected.

TABLE V-4
SAN JACINTO RIVER TIDAL
SCHEDULE OF PROJECTED CONSTRUCTION NEEDS

Geographical Planning Area	Plant Or Service Area	Existing Capacity Treatment Level	Projected Construction Needs			Estimated Dry Weather Flow/ Total Capacity Available (MGD)				Comments
			1977-1983	1984-1990	1991-1995	1977	1983	1990	1995	
SJR-1	FWSD 58	0.1/1	Collect - 40	Collect - 40	Collect - 20	0.04/0.1	0.05/0.1	0.05/0.1	0.05/0.1	
	WCID 70	0.05/1	Expand to 0.16/1 Collect - 320	Collect - 280	Collect - 200	0.09/0.05	0.11/0.16	0.14/0.16	0.16/0.16	
	HC MUD 20	0.45/1	Collect - 280	Collect - 250	Collect - 180	0.12/0.45	0.15/0.45	0.19/0.45	0.2/0.45	
	Arcadian Gardens	0.09/1	Collect - 200	Collect - 180	Collect - 130	0.05/0.09	0.06/0.09	0.08/0.09	0.09/0.09	No information on existing plant provided in Inputs. Capacity/Treatment Level assumed adequate.
	Crosby MUD	0.25/1	Collect - 360	Collect - 320	Collect - 230	0.12/0.25	0.15/0.25	0.19/0.25	0.2/0.25	
	WCID 1	0.75/1	Collect - 1560	Collect - 1370	Collect - 980	0.22/0.75	0.34/0.75	0.49/0.75	0.59/0.75	
SJR-2	Baytown West	0.7/1	New plant at 1.3/1 Collect - 1100	Collect - 1000	Collect - 700	0.88/0.7	0.98/1.3	1.1/1.3	1.2/1.3	Based on Facility Plan information.
	FWSD 48-2	0.2/1	Expand to 0.26/1	-	-	0.26/0.2	0.26/0.26	0.26/0.26	0.26/0.26	
	FWSD 48-1	0.21/1	Collect - 40	Collect - 80	-	0.16/0.21	0.18/0.21	0.19/0.21	0.2/0.21	
	HC WCID 84 (Channelview)	1.0/1	Collect - 860	Collect - 790	Collect - 600	0.04/1.0	0.09/1.0	0.15/1.0	0.2/1.0	
					Total Flow/Capacity	2.0/3.8	2.4/4.6	2.8/4.6	3.2/4.6	

Notes: 1) Existing Capacity/Treatment Level based on information provided by the municipal inventory (Activity 1) or Facility Plans.
2) See Table V-[illegible] for costs.

TABLE V-5
SAN JACINTO RIVER TIDAL
ESTIMATED COSTS OF WASTEWATER TREATMENT

Geographical Planning Area	Plant or Service Area	Estimated Capital Costs 1977-1983 Treat	Estimated Capital Costs 1977-1983 Collect	Estimated Capital Costs 1984-1990 Treat	Estimated Capital Costs 1984-1990 Collect	Estimated Capital Costs 1991-1995 Treat	Estimated Capital Costs 1991-1995 Collect	Estimated Annual Operation and Maintenance Costs 1977-1983 Treat	Estimated Annual Operation and Maintenance Costs 1977-1983 Collect	Estimated Annual Operation and Maintenance Costs 1984-1990 Treat	Estimated Annual Operation and Maintenance Costs 1984-1990 Collect	Estimated Annual Operation and Maintenance Costs 1991-1995 Treat	Estimated Annual Operation and Maintenance Costs 1991-1995 Collect	Comments
SJR-1	FWSD 58	0	9,000	0	9,000	0	5,000	34,000	2,000	34,000	2,000	34,000	2,000	
	WCID 70	340,000	70,000	0	62,000	0	44,000	40,000	1,000	40,000	1,000	40,000	1,000	
	HCMUD 20	0	62,000	0	55,000	0	40,000	55,000	1,000	55,000	1,000	55,000	1,000	
	ARCADIAN GARDENS	0	44,000	0	40,000	0	29,000	34,000	2,000	34,000	2,000	34,000	2,000	
	CROSBY MUD	0	79,000	0	70,000	0	51,000	46,000	2,000	46,000	3,000	46,000	3,000	
	WCID 1	0	343,000	0	301,000	0	216,000	65,000	11,000	65,000	14,000	65,000	15,000	
	BAYTOWN WEST	4,697,000	242,000	0	220,000	0	154,000	80,000	9,000	80,000	11,000	80,000	12,000	Treatment capital costs based on facility plan information
SJR-2	FWSD 48-2	270,000	0	0	0	0	0							
	FWSD 48-1	0	9,000	0	18,000	0	0	46,000	2,000	46,000	2,000	46,000	2,000	
	HC WCID 84 (CHANNELVIEW)	0	189,000	0	174,000	0	132,000	43,000	1,000	43,000	1,000	43,000	1,000	
								70,000	2,000	70,000	3,000	70,000	4,000	
	Subtotal	5,300,000	1,044,000	0	949,000	0	671,000	513,000	33,000	513,000	40,000	513,000	43,000	
	Total by Period	6,344,000		949,000		671,000		546,000		553,000		556,000		
	Amortized Capital Cost							524,000		602,000		658,000		
	Total Annual Cost							1,070,000		1,155,000		1,214,000		
	$/1000 gal							$1.33		$1.22		$1.11		

Notes: 1) See Table V-4 for construction actions required.
2) Capital costs amortized at 7% over 30 years.
3) [illegible] based on 1975 dollars.

The associated estimated cost for capital expenses and annual operational and maintenance expenses are summarized in Table V-6. Also included in the Table is an estimate for the total cost per 1,000 gallons for treatment of wastewater based on average daily dry weather flow during the time period.

TABLE V-6

SUMMARY OF ESTIMATED COSTS*
SAN JACINTO RIVER

Period	Capital Cost (Total)	O & M Cost (Annual Avg.)	Total Cost ($/1,000 Gallons)
1977 - 1983	6,340,000	546,000	1.33
1984 - 1990	950,000	553,000	1.22
1991 - 1995	670,000	556,000	1.11

* Costs based on 1975 dollars.

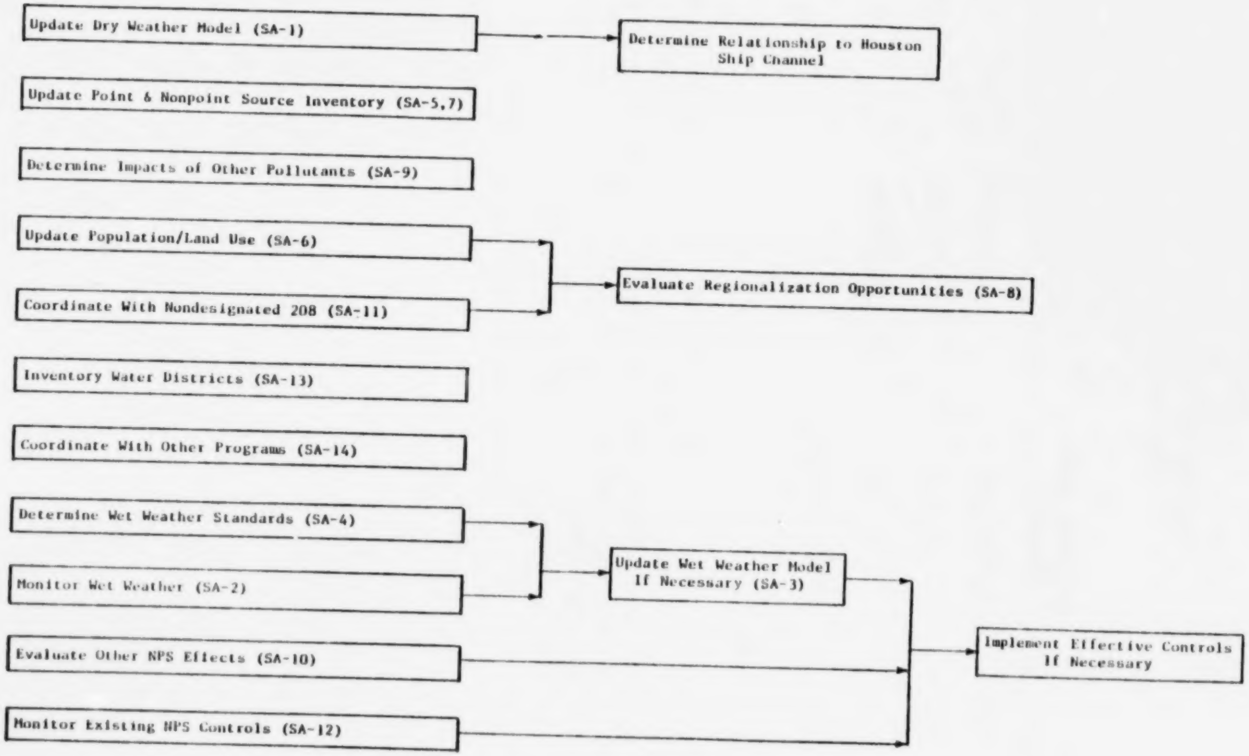
Action Checklist

Items required to implement the 208 plan in the San Jacinto River Tidal segment have been identified in this chapter. Figure V-2 presents the interrelationships between activities, decisions, and ongoing planning efforts. Special activities (SA) identified in the figure refer to those previously described. Priorities and further definitions for the special activities were presented in Chapter II.

FIGURE V-2

INTERRELATIONSHIP OF IMPLEMENTATION REQUIREMENTS

SAN JACINTO RIVER TIDAL


Update Dry Weather Model (SA-1)
Determine Relationship to Houston Ship Channel
Update Point & Nonpoint Source Inventory (SA-5,7)
Determine Impacts of Other Pollutants (SA-9)
Update Population/Land Use (SA-6)
Coordinate With Nondesignated 208 (SA-11)
Evaluate Regionalization Opportunities (SA-8)
Inventory Water Districts (SA-13)
Coordinate With Other Programs (SA-14)
Determine Wet Weather Standards (SA-4)
Monitor Wet Weather (SA-2)
Update Wet Weather Model If Necessary (SA-3)
Evaluate Other NPS Effects (SA-10)
Monitor Existing NPS Controls (SA-12)
Implement Effective Controls If Necessary

Buffalo Bayou

Technical Subplan

Point Sources. The technical subplan for point source discharges into Buffalo Bayou is to operate existing and future wastewater treatment plants at the existing permit conditions.

Nonpoint Sources. Significant amounts of storm water related nonpoint source waste enter Buffalo Bayou. However, wet weather modeling has not been performed on this stream and therefore no definitive conclusions can be drawn at this stage.

Other. Other 208 plan recommendations for Buffalo Bayou include:

1) Classify Buffalo Bayou between the Turning Basin and Addicks/Barker dams, for noncontact recreation and preservation of bayou aesthetics.

2) Determine water quality standards consistent with classification.

3) Extend Houston Ship Channel model to include the classified section of Buffalo Bayou.

Impact on Regulatory Function

Permitting. The 208 plan recommends that the existing level of permitted discharge into Buffalo Bayou be continued. The general level throughout the segment is effluent set 2 except for the Northside/69th Street complex which is permitted at effluent set 2N. Therefore, no major impacts on the permitting function are anticipated at this time.

Monitoring. Monitoring efforts in the Buffalo Bayou drainage area will continue to assess the segment water quality and the effluent quality through the existing mechanisms. Additional monitoring in the area should be directed toward verification and updating of the data base including, population/land use and wet weather water quality.

Standards. The 208 plan recommends that Buffalo Bayou be classified for noncontact recreation and preservation of bayou aesthetics. The plan further recommends that standards consistent with the classification be determined and implemented. Both dry weather and wet weather quality standards should be developed.

Allocations. It is recommended that allocations be developed in conjunction with the stream classification process.

Special Activities Required to Implement

A complete list of the continuing planning and special programs included as part of the 208 recommendations was presented in Chapter II. Programs specific to Buffalo Bayou are summarized below. A complete description of the program is contained in the Appendix.

1) Expand existing Houston Ship Channel steady-state model to include the area of Buffalo Bayou recommended for classification (as described in Houston Ship Channel section).

2) Define water uses and numerical water quality standards as part of the classification process.

3) Monitor wet weather water quality. Emphasis should be on developing a data base for input to applicable standards.

4) Develop dry and wet weather water quality standards consistent with bayou classification.

5) Update the point source inventory. Emphasis should be directed toward maintaining accurate and up-to-date information that is easily updated. This will provide input to future planning efforts.

6) Update the population and land use data. Emphasis should be on computerization of data base to allow greatest flexibility of the data. Applications of this activity include re-evaluation of allocations, nonpoint source wasteload evaluation, problem area prediction, etc.

7) Update nonpoint source wasteload identification and projections. Emphasis should be directed toward dry weather contributions. Information developed should be incorporated into the existing steady-state model where applicable.

8) Evaluate regionalization opportunities. Emphasis should be on coordination of the 201 program and evaluation of planning areas during the pre-grant application phase.

9) Determine impacts of other pollutants on Buffalo Bayou water quality. Emphasis should be on heavy metals and toxic materials as well as suspended solids.

10) Evaluate impacts of nonpoint source wasteloads on a basis other than the effects on water quality. Emphasis should be directed toward erosion, flood control, transportation, air quality, etc. The results will be used to interface with other environmental programs as required by 208.

11) Monitor and analyze all existing nonpoint source controls in the Buffalo Bayou area. Emphasis should be on cataloguing controls and evaluating performance in order to develop data base for a refined nonpoint source control program throughout the area.

12) Inventory and map all existing water districts and service areas in the basin. This effort will be part of the updated data base for ongoing planning.

13) Coordinate 208 plans and implementations with other environmental programs including air quality, transportation, solid waste, 201, 303, coastal management, and parks and recreation projects.

Phasing and Costs

Population and land use projections were utilized along with existing 201 plans as the basis for projecting the future wastewater treatment and conveyance system facility needs in Buffalo Bayou. Table V-7 presents the phasing for three distinct time periods, for new municipal facilities, broken down by geographical planning areas. Table V-8 presents the associated cost estimates, both capital and

TABLE V-7
BUFFALO BAYOU
SCHEDULE OF PROJECTED CONSTRUCTION NEEDS

Geographical Planning Area	Plant Or Service Area	Existing Capacity Treatment Level	Projected Construction Needs			Estimated Dry Weather Flow/ Total Capacity Available (MGD)				Comments
			1977-1983	1984-1990	1991-1995	1977	198[illegible]	1990	1995	
BB-1	Katy	1.5/2	Collect - 2100	Collect - 800	Collect - 500	0.5/1.5	0.63/1.5	0.67/1.5	0.7/1.5	Upgrading may be required in 1984-90 time frame upon determination of water quality standards consistant with non-contact recreation in Buffalo Bayou.
BB-2	Johnson MUD	-	New Plant at 0.01/2 Collect - 40	Collect - 60	-	0.0/0.0	0.004/0.01	0.008/0.01	0.01/0.01	
BB-3	FB MUD 7	-	New Plant at 0.28/2 Collect - 380	Collect - 340	Collect - 240	0.0/0.0	0.11/0.28	0.21/0.28	0.28/0.28	
BB-4	HC MUD 64	-	New Plant at 0.01/2 Collect - 50		-	0.0/0.0	0.001/0.01	0.002/0.01	0.003/0.01	
	Weston MUD	-	New Plant at 0.13/2 Collect - 700	Collect - 400	Collect - 200	0.0/0.0	0.07/0.13	0.11/0.13	0.13/0.13	
	Castlewood	-	New Plant at 0.01/2 Collect - 50	-	-	0.0/0.0	0.001/0.01	0.002/0.01	0.003/0.01	
	HC MUD 71	-	New Plant at 0.03/2 Collect - 100	Collect - 100	Collect - 100	0.0/0.0	0.01/0.03	0.02/0.03	0.03/0.03	
	Westlake MUD	0.6/2	Collect - 2000	Collect - 350	Collect - 300	0.27/0.6	0.22/0.6	0.23/0.6	0.24/0.6	
	Addicks UD	0.5/2	Collect - 1700	Collect - 100	Collect - 100	0.001/0.5	0.17/0.5	0.19/0.5	0.2/0.5	
	WCID 134	1.0/2	Expand to 1.6/2 Collect - 1300	Collect - 1200	Collect - 800	1.3/1.0	1.4/1.6	1.5/1.6	1.6/1.6	
	Interstate MUD	-	New Plant at 0.06 Collect - 200	Collect - 200	Collect - 100	0.0/0.0	0.02/0.06	0.05/0.06	0.06/0.06	
BB-5	Park Ten MUD	0.2/2	-	Expand to 0.36/2	-	0.05/0.2	0.15/0.2	0.28/0.36	0.36/0.36	
	Bear Creek UD	0.2/2	-	-	-	0.004/0.2	0.004/0.2	0.004/0.2	0.004/0.2	
	Jackrabbit PUD	0.6/2	Collect - 600	Collect - 540	Collect - 400	0.12/0.6	0.16/0.6	0.21/0.6	0.25/0.6	
	HC MUD 102	0.5/2	Collect - 400	Collect - 500	Collect - 30	0.02/0.5	0.06/0.5	0.11/0.5	0.15/0.5	
	Spencer Rd PUD	0.25/2	-	Collect - 70	-	0.001/0.25	0.003/0.25	0.006/0.25	0.008/0.25	
BB-6	Turkey Creek	1.5/2	Expand to 6.0/2 Collect - 3330	Collect - 2910	Collect - 2750	0.45/1.5	3.4/6.0	4.1/6.0	4.7/6.0	Based on preliminary Facility Plan information.
BB-7	HC MUD 107	0.1/2	Expand to 0.55/2 Collect - 2100	Collect - 1800	Collect - 1280	0.08/0.1	0.24/0.55	0.42/0.55	0.55/0.55	
	West District	17.0/2	Expand to 20.0/2 Divert 2.0 mgd to Turkey Creek Collect - 32,900	Collect - 26,900	Collect - 21,000	15.1/17.0	18.5/20.0	21.4/20.0	23.6/20.0	Based on preliminary Facility Plan information.
	Sherwood Oaks	0.75/2	Abandon to West District Collect - 930	Collect - 870	Collect - 240	0.77/0.75	0.0/0.0	0.0/0.0	0.0/0.0	Based on preliminary Facility Plan information.
BB-8	Memorial Village WA	1.3/2	Expand to 2.2/2 Collect - 2200	Collect - 1900	Collect - 1400	1.8/1.3	1.9/2.2	2.1/2.2	2.2/2.2	
BB-9	Northside/ 69th Street	32.0/2	Expand to 132.0/2N Collect - 39,000	Collect - 55,700	Collect - 52,800	73.0/32.0	100.0/132.0	110.4/132.0	120.2/132.0	Based on preliminary Facility Plan information.
						Total Flow/Capacity [illegible]	127.0/158.0	[illegible]	155.3/167.4	

Notes: 1) Existing Capacity/Treatment Level based on information provided by the [illegible] ipal inventory [illegible] Facility Plans.
2) [illegible]

TABLE V-8
BUFFALO BAYOU
ESTIMATED COSTS OF WASTEWATER TREATMENT

Geographical Planning Area	Plant or Service Area	Estimated Capital Costs						Estimated Annual Operation and Maintenance Costs						Comments
		1977-1983		1984-1990		1991-1995		1977-1983		1984-1990		1991-1995		
		Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	
BB-1	KATY	0	462,000	0	176,000	0	110,000	104,000	7,000	104,000	11,000	104,000	11,000	
BB-2	JOHNSON MUD	168,000	9,000	0	13,000	0	0	24,000	500	24,000	500	24,000	500	
BB-3	FB MUD 7	576,000	84,000	0	75,000	0	53,000	53,000	1,000	53,000	1,000	53,000	1,000	
BB-4	HC MUD 64	168,000	11,000	0	0	0	0	24,000	500	24,000	500	24,000	500	
	WESTON MUD	408,000	154,000	0	88,000	0	44,000	41,000	1,000	41,000	2,000	41,000	2,000	
	CASTLEWOOD	168,000	11,000	0	0	0	0	24,000	500	24,000	500	24,000	500	
	HC MUD 71	240,000	22,000	0	22,000	0	22,000	29,000	500	29,000	500	29,000	500	
	WESTLAKE MUD	0	440,000	0	77,000	0	66,000	68,000	4,000	68,000	5,000	68,000	5,000	
	ADDICKS UD	0	374,000	0	22,000	0	22,000	65,000	3,000	65,000	3,000	65,000	3,000	
	WCID 134	828,000	286,000	0	264,000	0	176,000	105,000	5,000	105,000	7,000	105,000	8,000	
	INTERSTATE MUD	300,000	44,000	0	44,000	0	22,000	34,000	500	34,000	1,000	34,000	1,000	
	PARK TEN MUD	0	0	444,000	0	0	0	47,000	500	57,000	500	57,000	500	
BB-5	BEAR CREEK UD	0	0	0	0	0	0	47,000	500	47,000	500	47,000	500	
	JACK RABBIT PUD	0	132,000	0	119,000	0	88,000	68,000	4,000	68,000	4,000	68,000	5,000	
	HC MUD 102	0	88,000	0	110,000	0	7,000	65,000	1,000	65,000	2,000	65,000	2,000	
	SPENCER RD PUD	0	0	0	0	0	0	52,000	500	52,000	500	52,000	500	
BB-6	TURKEY CREEK	5,464,000	733,000	0	640,000	0	605,000	360,000	15,000	360,000	18,000	360,000	22,000	Turkey Creek, West District, Sherwood Oaks, and Northside based on preliminary Facility Plan Information
	HC MUD 107	732,000	462,000	0	396,000	0	282,000	66,000	3,000	66,000	6,000	66,000	8,000	
BB-7	WEST DISTRICT	6,132,000	7,238,000	0	5,918,000	0	4,620,000	1,090,000	207,000	1,090,000	247,000	1,090,000	278,000	
	SHERWOOD OAKS	1,328,000	205,000	0	191,000	0	53,000	17,000	11,000	17,000	13,000	17,000	13,000	
BB-8	MEMORIAL VILLAGE	1,008,000	484,000	0	418,000	0	308,000	129,000	31,000	129,000	34,000	129,000	36,000	
BB-9	NORTHSIDE/ 69th STREET	181,702,000	8,580,000	0	12,300,000	0	11,600,000	3,440,000	802,000	3,440,000	885,000	3,440,000	964,000	
	Subtotal	199,220,000	19,819,000	444,000	20,873,000	0	18,078,000	5,982,000	1,099,000	5,982,000	1,243,000	5,982,000	1,363,000	
	Total by Period	219,039,000		21,317,000		18,078,000		7,081,000		7,225,000		7,345,000		
							Amortized Capital Cost	18,093,000		19,853,000		21,264,000		
							Total Annual Cost	25,174,000		27,078,000		28,609,000		
							Cost/1000 gal	$.63		$.55		$.53		

Notes: 1) See Table V-7 for construction actions required.
2) Capital costs amortized at 7% over 30 years.
3) Costs based on 1975 dollars.

operational and maintenance, for the projected facilities, also on a geographical planning area basis.

In Buffalo Bayou, the projected new facilities for the 1977-1983 time period include:

1) Seven new treatment plants with a total capacity of 0.53 MGD.

2) Six plant expansions increasing capacity by approximately 110 MGD.

3) New collection facilities serving an additional 90,100 persons.

New facilities projected for the 1984-1990 time period include:

1) One plant expansion, increasing capacity by 0.16 MGD.

2) New collection facilities serving an additional 94,700 persons.

New collection system facilities are projected for the final time period, 1991-1995, serving an additional 82,200 persons.

The associated estimated costs for capital expenses and annual operational and maintenance expenses are summarized in Table V-9. Also included in the Table is an estimate for the total cost per 1000 gallons for treatment of wastewater based on average daily dry weather flow during the time period.

TABLE V-9

SUMMARY OF ESTIMATED COSTS*
BUFFALO BAYOU

Period	Capital Cost (Total)	O & M Cost (Annual Avg.)	Total Cost ($/1,000 Gallons)
1977 - 1983	219,000,000	7,080,000	0.63
1984 - 1990	21,300,000	7,230,000	0.55
1991 - 1995	18,100,000	7,350,000	0.53

* Costs based on 1975 dollars.

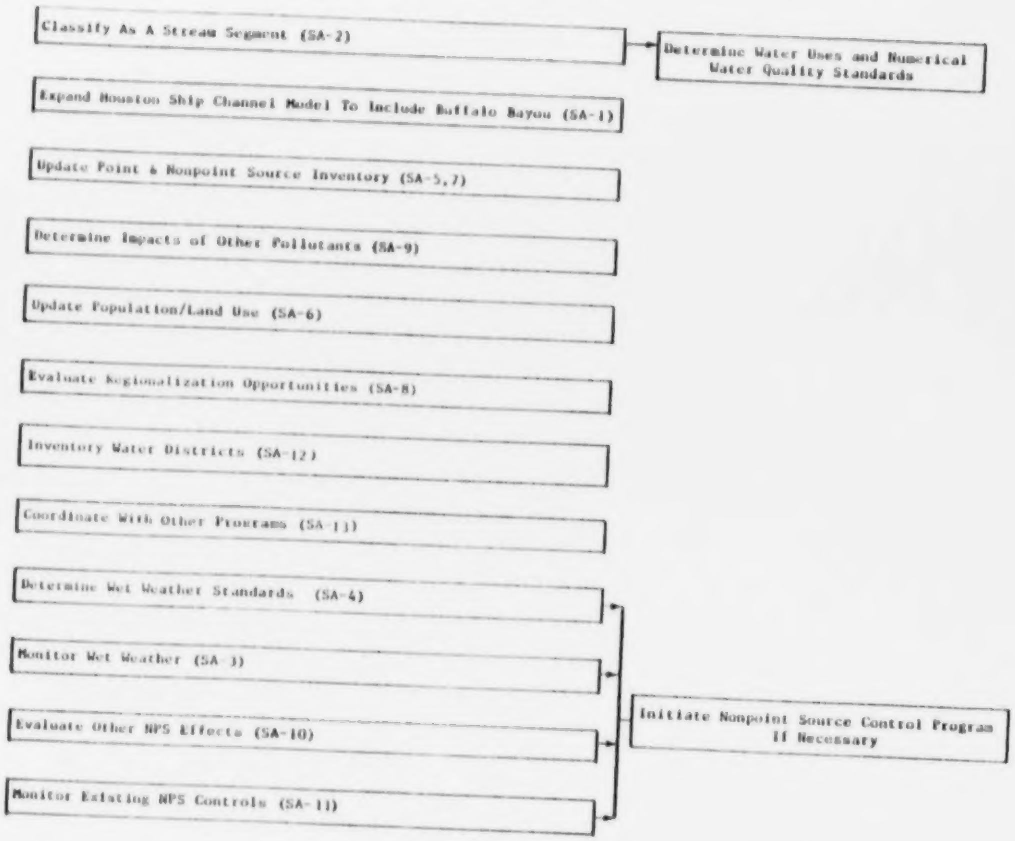
Action Check List

Items required to implement the 208 plan in Buffalo Bayou have been identified in this chapter. Figure V-3 presents the interrelationships between activities, decisions, and ongoing planning efforts. Special activities (SA) identified in the figure refer to those previously described. Priorities and further definition for the special activities was presented in Chapter II.

FIGURE V-3

INTERRELATIONSHIP OF IMPLEMENTATION REQUIREMENTS

BUFFALO BAYOU


Classify As A Stream Segment (SA-2)
Determine Water Uses and Numerical Water Quality Standards
Expand Houston Ship Channel Model To Include Buffalo Bayou (SA-1)
Update Point & Nonpoint Source Inventory (SA-5,7)
Determine Impacts of Other Pollutants (SA-9)
Update Population/Land Use (SA-6)
Evaluate Regionalization Opportunities (SA-8)
Inventory Water Districts (SA-12)
Coordinate With Other Programs (SA-13)
Determine Wet Weather Standards (SA-4)
Monitor Wet Weather (SA-3)
Evaluate Other NPS Effects (SA-10)
Monitor Existing NPS Controls (SA-11)
Initiate Nonpoint Source Control Program If Necessary

Other Tributaries of the Houston Ship Channel

Technical Subplan

General. Unclassified water bodies included in this category include Brays, Sims, White Oak, Hunting, Vince, Greens/Halls, and Carpenters Bayous.

Point Sources. The technical subplan for point source dischargers into the tributaries is to operate existing and future wastewater treatment plants at the existing permitted conditions.

Nonpoint Sources. Significant amounts of stormwater related nonpoint source wastes enter the other tributaries to the Houston Ship Channel. However, wet weather modeling has not been performed on these segments and therefore no definitive conclusions can be drawn at this stage.

Other. Additional 208 plan recommendations include:

1) Do not classify any of these bayous at this time. Continue to evaluate, on an individual basis, the desirability of classification.

2) Meet fecal coliform levels of less than 200 MPN/100 ml.

Impact on Regulatory Function

Permitting. The 208 plan recommends that the existing level of permitted discharge into the bayous be continued. The general level of discharge is effluent set 2. Therefore, no major impacts on the permitting function are anticipated at this time.

Monitoring. Monitoring efforts in the tributary drainage area. will continue to assess the segment water quality and the effluent water quality through the existing mechanisms. Additional monitoring in the area should be directed toward updating the data base including population and land use.

Stream Standards. The 208 plan recommends that these bayous presently remain unclassified and that no standards be developed for the segments.

Allocations. Allocations will be developed if and when additional tributaries are recommended for classification.

Special Activities Required to Implement

A complete list of the continuing planning and special programs included as part of the 208 recommendations was presented in Chapter II. Programs specific to the tributary bayous are summarized below. A complete description of the program is contained in the Appendix.

1) Continue to evaluate the desirability of classifying the tributary bayous on an individual basis.

2) Expand existing Houston Ship Channel steady-state model to include major tributaries.

3) Monitor wet weather water quality. Emphasis should be on developing a data base.

4) Update the point source inventory. Emphasis should be directed toward maintaining accurate and up-to-date information that is easily updated. This will provide input to future planning efforts.

5) Update the population and land use data. Emphasis should be on computerization of data base to allow greatest flexibility of the data. Applications of this activity include re-evaluation of allocations, nonpoint source wasteload evaluation, problem area prediction, etc.

6) Update nonpoint source wasteload identification and projections. Emphasis should be directed towards verifying dry weather as well as wet weather contributions in the segments.

7) Evaluate regionalization opportunities. Emphasis should be on coordination of the 201 program and evaluation of planning areas during the pre-grant application phase.

8) Evaluate impacts of nonpoint source wasteloads on a basis other than the effects on water quality. Emphasis should be directed toward erosion, flood control, transportation, air quality, etc. The results will be used to interface with other environmental programs as required by 208.

9) Monitor and analyze all existing nonpoint source controls in the Bayou area. Emphasis should be on cataloguing controls and evaluating performance in order to develop a data base for a refined nonpoint source control program throughout the area.

10) Inventory and map all existing water districts and service areas. This effort will be part of the updated data base for ongoing planning.

11) Coordinate 208 plans and implementation with other environmental programs including air quality, transportation, solid waste, 201, 303, coastal management, and parks and recreation projects.

Phasing and Costs

Population and land use projections were utilized along with existing 201 plans as the basis for projecting the future wastewater treatment and conveyance system facility needs in other tributaries of the Houston Ship Channel. Tables V-10, 12, 14, 16, 18 present the phasing for three distinct time periods, for new municipal facilities, broken down by geographical planning areas. Tables V-11, 13, 15, 17, 19 present the associated cost estimates, both capital and operational and maintenance, for the projected facilities, also on a geographical basis.

In the tributary bayous' drainage area, the projected new facilities for the 1977-1983 time period include:

1) Ten new treatment plants with a total capacity of approximately 5.5 MGD.

2) Sixteen plant expansions, increasing capacity by approximately 50.0 MGD.

3) New collection facilities with additional capacity for approximately 221,900 persons.

In the 1984-1990 time period, new facilities are projected to include:

1) One plant expansion increasing total capacity by 20.0 MGD.

2) New collection facilities with capacity for an additional 222,700 persons.

TABLE V-10
WHITE OAK BAYOU
SCHEDULE OF PROJECTED CONSTRUCTION NEEDS

Geographical Planning Area	Plant Or Service Area	Existing Capacity Treatment Level	Projected Construction Needs			Estimated Dry Weather Flow/ Total Capacity Available (MGD)				Comments
			1977-1983	1984-1990	1991-1995	1977	1983	1990	1995	
WO-1	HC FWSD 61	0.3/2	Expand to 0.4/2 Collect - 620	Collect - 550	Collect - 390	0.30/0.30	0.34/0.40	0.38/0.4	0.4/0.4	
	Reid Rd. MUD 1	0.5/2	-	Collect - 50	-	0.001/0.05	0.002/0.05	0.004/0.05	0.005/0.05	
WO-2	Jersey Village	0.28/2	Expand to 0.55/2 Collect - 1520	Collect - 1330	Collect - 950	0.19/0.28	0.31/0.55	0.45/0.55	0.55/0.55	
	Rolling Fork UD	0.3/2	Collect - 40	Collect - 60	-	0.03/0.3	0.03/0.3	0.04/0.3	0.04/0.3	
	HC MUD 23	0.18/2	Collect - 680	Collect - 600	Collect - 420	0.03/0.18	0.08/0.18	0.14/0.18	0.18/0.18	No information on existing plant provided in inputs. Capacity/Treatment Level assumed adequate.
	HC MUD 6	0.9/2	Collect - 320	Collect - 330	Collect - 150	0.03/0.9	0.05/0.9	0.08/0.9	0.09/0.9	
	WCID 133	1.0/2	Collect - 1600	Collect - 1400	Collect - 1000	0.22/1.0	0.37/1.0	0.53/1.0	0.64/1.0	
	White Oak MUD	2.0/2	Collect - 1840	Collect - 1610	Collect - 1150	0.42/2.0	0.46/2.0	0.51/2.0	0.54/2.0	
	West Mont.Util.Co.	0.28/2	-	-	-	0.18/0.28	0.18/0.28	0.18/0.28	0.18/0.28	
WO-3	Northwest	12.0/2	Collect - 28,000	Collect - 28,200	Expand to 18.0/2 Collect - 24,700	6.6/12.0	9.0/12.0	12.0/12.0	14.6/18.0	Based on preliminary Facility Plan information. Expansion to 8.0 mgd currently under construction.
					Total Flow/Capacity	8.0/17.3	10.8/17.7	14.3/17.7	17.2/23.7	

Notes: 1) Existing Capacity/Treatment Level based on information provided by the municipal inventory (Activity 3) or Facility Plans.
2) Table V-11 for costs.

TABLE V-11
WHITE OAK BAYOU
ESTIMATED COSTS OF WASTEWATER TREATMENT

Geographical Planning Area	Plant or Service Area	Estimated Capital Costs						Estimated Annual Operation and Maintenance Costs						Comments
		1977-1983		1984-1990		1991-1995		1977-1983		1984-1990		1991-1995		
		Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	
WO-1	HC FWSD 61	360,000	136,000	0	121,000	0	86,000	61,000	3,000	61,000	4,000	61,000	5,000	
	REID RD MUD 1	0	0	0	11,000	0	0	65,000	500	65,000	500	65,000	500	
WO-2	JERSEY VILLAGE	570,000	334,000	0	293,000	0	209,000	66,000	4,000	66,000	6,000	66,000	8,000	
	ROLLING FORK UD	0	9,000	0	13,000	0	0	54,000	500	54,000	500	54,000	500	
	HC MUD 23	0	150,000	0	132,000	0	92,000	46,000	1,000	46,000	2,000	46,000	3,000	
	HC MUD 6	0	70,000	0	73,000	0	33,000	78,000	2,000	78,000	2,000	78,000	2,000	
	WCID 133	0	352,000	0	308,000	0	220,000	81,000	6,000	81,000	8,000	81,000	9,000	
	WHITE OAK MUD	0	405,000	0	354,000	0	253,000	118,000	3,000	118,000	5,000	118,000	7,000	
	WEST MONT. UTILITY CO.	0	0	0	0	0	0	53,000	3,000	53,000	3,000	53,000	3,000	
WO-3	NORTHWEST	0	6,160,000	0	6,204,000	5,124,000	5,434,000	360,000	126,000	360,000	169,000	472,000	206,000	Based on preliminary facility plan information
	Subtotal	930,000	7,616,000	0	7,509,000	5,124,000	6,327,000	982,000	149,000	982,000	200,000	982,000	244,000	
	Total by Period	8,546,000		7,509,800		11,451,000		1,131,000		1,182,000		1,226,000		
	Amortized Capital Cost							706,000		1,326,000		2,272,000		
	Total Annual Cost							1,837,000		2,508,000		3,498,000		
	Cost/1000 gal							$.54		$.65		$.72		

1) See Table V-10 for construction actions required.
2) Capital costs amortized at 7¼% over 30 years.
3) Costs based on 1975 dollars.

TABLE V-12
BRAYS BAYOU
SCHEDULE OF PROJECTED CONSTRUCTION NEEDS

Geographical Planning Area	Plant Or Service Area	Existing Capacity Treatment Level	Projected Construction Needs 1977-1983	Projected Construction Needs 1984-1990	Projected Construction Needs 1991-1995	Estimated Dry Weather Flow/Total Capacity Available (MGD) 1977	1983	1990	1995	Comments
BRB-1	HC MUD 84	-	New plant at 0.01/2 Collect - 40	Collect - 60	-	0.0/0.0	0.004/0.01	0.008/0.01	0.01/0.01	
	Chelford City MUD	0.6/2	-	Collect - 200	Collect - 100	0.0/0.0	0.03/0.6	0.05/0.6	0.07/0.6	
BRB-2	Westheimer Rd MUD	0.9/2	Collect - 770	Collect - 680	Collect - 480	0.33/0.9	0.4/0.9	0.44/0.9	0.5/0.9	
	Candlewood MUD	-	New plant at 0.02/2 Collect - 80	Collect - 70	Collect - 50	0.0/0.0	0.008/0.02	0.01/0.02	0.02/0.02	
	Rosewood MUD	0.4/2	Collect - 200	Collect - 250	Collect - 170	0.01/0.4	0.01/0.4	0.03/0.4	0.03/0.4	
BRB-3	Bissonnet	0.6/2	-	Collect - 250	Collect - 175	0.0/0.0	0.03/0.6	0.06/0.6	0.08/0.6	
	Brookfield MUD	0.5/2	Collect - 1500	Collect - 1300	Expand to 0.62/2 Collect - 950	0.11/0.5	0.28/0.5	0.47/0.5	0.62/0.62	
	WCID 111	0.5/2	Collect - 1000	Collect - 800	Collect - 600	0.3/0.5	0.37/0.5	0.46/0.5	0.53/0.5	
	HC MUD 123	-	New plant at 0.73/2 Collect - 2900	Collect - 2600	Collect - 1800	0.0/0.0	0.29/0.73	0.55/0.73	0.73/0.73	
	HC MUD 42	-	New plant at 0.09/2 Collect - 300	Collect - 300	Collect - 200	0.0/0.0	0.04/0.09	0.06/0.09	0.09/0.09	
	Parkglen MUD	2.0/2	Collect - 4300	Collect - 3800	Collect - 2700	0.86/2.0	1.2/2.0	1.6/2.0	1.9/2.0	
	Meadows MUD	0.5/2	Collect - 330	Collect - 300	Collect - 200	0.45/0.5	0.47/0.5	0.5/0.5	0.52/0.5	
	HC MUD 139 (S)	0.1/2	-	Collect - 100	Collect - 70	0.0/0.0	0.01/0.1	0.02/0.1	0.03/0.1	
	Fondren Rd. MUD	0.4/2	-	-	-	0.25/0.4	0.23/0.4	0.2/0.4	0.19/0.4	
	HC MUD 139	0.05/2	-	Collect - 100	Collect - 60	0.0/0.0	0.01/0.05	0.02/0.05	0.03/0.05	
BRB-4	WCID 78	0.5/2	Expand to 1.4/2 Collect - 4300	Collect - 5000	Expand to 1.72/2 Collect - 3600	0.41/0.5	0.84/1.4	1.4/1.4	1.72/1.72	
	WCID 104	0.35/2	Expand to 0.6/2 Collect - 660	Collect - 580	Collect - 400	0.42/0.35	0.47/0.6	0.54/0.6	0.6/0.6	
	HC UD 11	1.0/2	Collect - 40	Collect - 40	Collect - 30	0.06/1.0	0.08/1.0	0.1/1.0	0.12/1.0	
	WCID 94	1.0/2	-	-	-	0.74/1.0	0.65/1.0	0.55/1.0	0.47/1.0	
	WCID 90	0.9/2	-	-	-	0.66/1.0	0.57/1.0	0.46/1.0	0.39/1.0	
	Manning MUD	1.0/2	Collect - 1200	Collect - 1000	Collect - 700	0.12/1.0	0.2/1.0	0.31/1.0	0.38/1.0	
	Beltway MUD	-	New plant at 1.25/2 Collect - 6400	Collect - 6000	Expand to 1.67/2 Collect - 4000	0.0/0.0	0.67/1.25	1.25/1.25	1.67/1.67	
	Wilcrest	-	New plant at 0.1/2 Collect - 300	Collect - 300	Collect - 200	0.0/0.0	0.04/0.1	0.08/0.1	0.1/0.1	
BRB-5	Southwest	30.0/2	Expand to 50/2 Collect - 47,000	Collect - 35,000	Collect - 26,000	30.0/30.0	35.9/50.0	40.4/50.0	43.7/50.0	Phasing of plant: in BRB-5 based on preliminary Facility Planning information.
	Chadwick Manor	0.08	Abandon to SW Collect - 60	Collect - 50	Collect - 40	0.0/0.0	0.0/0.0	0.0/0.0	0.0/0.0	
	WCID 34	-	Abandon to SW Collect - 140	Collect - 160	Collect - 100	0.0/0.0	0.0/0.0	0.0/0.0	0.0/0.0	
BRB-6	Bellaire	1.5/2	Expand to 1.8/2	-	-	2.0/1.5	1.8/1.8	1.7/1.8	1.5/1.8	
	West Univ.	1.2/2	Expand to 1.65/2 Collect - 1200	Collect - 1000	Collect - 700	1.4/1.2	1.5/1.65	1.6/1.65	1.65/1.65	
	Southside Place	0.45/2	-	-	-	0.14/0.45	0.14/0.45	0.14/0.45	0.14/0.45	
					Total Flow/Capacity	38.3/43.2	46.2/69.5	53.0/69.5	57.8/70.0	

Notes: 1) Existing Capacity/Treatment Level based on information provided by the municipal inventory (Activity 3) or Facility Plans.
2) See Table V-13 for costs.

TABLE V-13
BRAYS BAYOU
ESTIMATED COSTS OF WASTEWATER TREATMENT

Geographical Planning Area	Plant or Service Area	Estimated Capital Costs						Estimated Annual Operation and Maintenance Costs						Comments
		1977-1983		1984-1990		1991-1995		1977-1983		1984-1990		1991-1995		
		Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	
BRB-1	HC MUD 84	168,000	9,000	0	13,000	0	0	24,000	500	24,000	500	24,000	500	
	CHELFORD CITY MUD	0	0	0	44,000	0	22,000	68,000	0	68,000	500	68,000	500	
BRB-2	WESTHEIMER RD MUD	0	169,000	0	150,000	0	106,000	78,000	2,000	78,000	3,000	78,000	4,000	
	CANDLEWOOD MUD	210,000	18,000	0	15,000	0	11,000	27,000	500	27,000	500	27,000	500	
	ROSEWOOD MUD	0	44,000	0	55,000	0	37,000	61,000	500	61,000	1,000	61,000	1,000	
BRB-3	BISSONETT MUD	0	0	0	55,000	0	39,000	68,000	0	68,000	500	68,000	1,000	
	BROOKFIELD MUD	0	330,000	0	286,000	390,000	209,000	65,000	4,000	65,000	6,000	69,000	7,000	
	WCID 111	0	220,000	0	176,000	0	132,000	65,000	9,000	65,000	10,000	65,000	11,000	
	HC MUD 123	912,000	638,000	0	572,000	0	396,000	72,000	4,000	72,000	8,000	72,000	11,000	
	HC MUD 42	348,000	66,000	0	66,000	0	44,000	37,000	500	37,000	1,000	37,000	1,000	
	PARKGLEN MUD	0	946,000	0	836,000	0	594,000	118,000	9,000	118,000	15,000	118,000	19,000	
	MEADOWS MUD	0	73,000	0	66,000	0	44,000	65,000	6,000	65,000	6,000	65,000	7,000	
	HC MUD 139 (S)	0	0	0	22,000	0	15,000	38,000	0	38,000	500	38,000	500	
	FONDREN RD	0	0	0	0	0	0	61,000	6,000	61,000	6,000	61,000	6,000	
	HC MUD 139	0	0	0	22,000	0	13,000	33,000	0	33,000	500	33,000	500	
BRB-4	WCID 78	1,008,000	946,000	0	1,100,000	624,000	792,000	97,000	6,000	97,000	14,000	110,000	19,000	
	WCID 104	552,000	145,000	0	128,000	0	88,000	68,000	3,000	68,000	4,000	68,000	5,000	
	HC UD 11	0	9,000	0	9,000	0	7,000	81,000	500	81,000	1,000	81,000	1,000	
	WCID 94	0	0	0	0	0	0	81,000	13,000	81,000	13,000	81,000	13,000	
	WCID 99	0	0	0	0	0	0	78,000	11,000	78,000	11,000	78,000	11,000	
	MANNING MUD	0	264,000	0	220,000	0	154,000	81,000	3,000	81,000	4,000	81,000	5,000	
	BELTWAY MUD	1,260,000	1,408,000	0	1,320,000	708,000	880,000	93,000	10,000	93,000	19,000	105,000	25,000	
	WILCREST	360,000	66,000	0	66,000	0	44,000	38,000	500	38,000	1,000	38,000	1,000	
BRB-5	SOUTHWEST	8,880,000	10,340,000	0	7,700,000	0	5,720,000	1,080,000	425,000	1,080,000	477,000	1,080,000	516,000	Based on preliminary Facility plan information
	CHADWICK MANOR	0	13,000	0	11,000	0	9,000	0	500	0	500	0	500	
	WCID 34	0	31,000	0	35,000	0	22,000	0	4,000	0	4,000	0	4,000	
BRB-6	BELLAIRE	3,600,000	0	0	0	0	0	112,000	32,000	112,000	32,000	112,000	32,000	
	WEST UNIVERSITY	732,000	264,000	0	220,000	0	154,000	105,000	19,000	105,000	20,000	105,000	21,000	
	SOUTHSIDE PLACE	0	0	0	0	0	0	62,000	1,000	62,000	1,000	62,000	1,000	
	Subtotal	15,030,000	15,999,000	0	13,187,000	1,722,000	9,532,000	2,856,000	570,000	2,856,000	669,000	2,885,000	725,000	
	Total by Period	31,029,000		13,187,000		11,254,000		3,426,000		3,525,000		3,610,000		
						Amortized Capital Cost		2,563,000		3,652,000		4,582,000		
						Total Annual Cost		5,989,000		7,177,000		8,192,000		
						Cost/1000 gal		$.39		$.40		$.41		

Note: 1) See Table V-12 for construction actions required
2) Capital costs amortized at 7¼% over 30 years.
3) Costs based on 1975 dollars.

TABLE V-14
SIMS BAYOU
SCHEDULE OF PROJECTED CONSTRUCTION NEEDS

Geographical Planning Area	Plant Or Service Area	Existing Capacity Treatment Level	Projected Construction Needs 1977-1983	1984-1990	1991-1995	Estimated Dry Weather Flow/ Total Capacity Available (MGD) 1977	1983	1990	1995	Comments
SB-1	Blue Ridge MUD	0.2/2	Collect - 700	Collect - 600	Collect - 400	0.06/0.2	0.1/0.2	0.16/0.2	0.2/0.2	
SB-2	Green Ridge MUD	0.5/2	Expand to 0.57 Collect - 540	Collect - 500	Collect - 300	0.47/0.5	0.51/0.57	0.54/0.57	0.57/0.57	
	WCID 51	8.0/2	Expand to 10.0/2 Collect - 9500	Collect - 9500	Collect - 7900	3.45/8.0	4.2/10.0	5.3/10.0	6.2/10.0	Phasing in SB-2 through SB-6 based on preliminary Facility Planning information.
	FWSD 34	1.0/2	Abandon to WCID 51 Collect - 1300	Collect - 1100	Collect - 900	0.0/0.0	0.0/0.0	0.0/0.0	0.0/0.0	
	Mayfair Park	0.4/2	Abandon to WCID 51 Collect - 900	Collect - 500	Collect - 900	0.0/0.0	0.0/0.0	0.0/0.0	0.0/0.0	
SB-3	Almeda Sims	20.0/2	Collect - 22,000	Expand to 40/2N Collect - 31,300	Collect - 32,000	23.6/20.0	26.5/20.0	32.4/40.0	38.4/40.0	
SB-4	Sims Bayou	48.0/2N	Expand to 60/2N Collect - 26,000	Collect - 28,500	Collect - 24,500	43.7/60.0	46.8/60.0	51.5/60.0	55.5/60.0	
SB-5	Chocolate Bayou	8.0/2	Collect - 3400	Collect - 5000	Collect - 5700	3.4/8.0	3.6/8.0	4.1/8.0	4.7/8.0	
SB-6	Easthaven	0.5/2	New plant at 2.0/2 Collect - 2160	Collect - 2630	Collect - 2560	0.57/0.5	0.75/2.0	1.1/2.0	1.3/2.0	
	District 47	3.0/2	Expand to 5.0/2 Collect - 3900	Collect - 5800	Collect - 8400	2.3/3.0	2.6/5.0	3.2/5.0	4.1/5.0	
SB-7	South Houston	1.5/2	Expand to 2.2/2 Collect - 1200	Collect - 1000	Collect - 700	1.9/1.5	2.0/2.2	2.1/2.2	2.2/2.2	
					Total Flow/Capacity	79.5/101.7	87.1/108.0	100.4/128.0	113.2/128.0	

Notes: 1) Existing Capacity/Treatment Level based on information provided by the municipal inventory (Activity 3) or Facility Plans.
2) See Table V-15 for costs.

TABLE V-15
SIMS BAYOU
ESTIMATED COSTS OF WASTEWATER TREATMENT

Geographical Planning Area	Plant or Service Area	Estimated Capital Costs						Estimated Annual Operation and Maintenance Costs						Comments
		1977-1983		1984-1990		1991-1995		1977-1983		1984-1990		1991-1995		
		Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	
SB-1	BLUE RIDGE MUD	0	150,000	0	132,000	0	88,000	47,000	3,000	47,000	3,000	47,000	4,000	
	GREENRIDGE MUD	312,000	119,000	0	110,000	0	66,000	68,000	6,000	68,000	7,000	68,000	7,000	
SB-2	WCID 51	1,800,000	2,090,000	0	2,090,000	0	1,738,000	294,000	57,000	294,000	71,000	294,000	83,000	
	FWSD 34	0	286,000	0	242,000	0	198,000	0	6,000	0	8,000	0	9,000	
	MAYFAIR PARK	0	138,000	0	110,000	0	198,000	0	5,000	0	5,000	0	7,000	
SB-3	ALMEDA SIMS	0	4,840,000	14,160,000	6,886,000	0	7,040,000	509,000	193,000	1,304,000	240,000	1,304,000	288,000	
SB-4	SIMS BAYOU	13,680,000	5,720,000	0	6,270,000	0	5,390,000	1,776,000	429,000	1,776,000	472,000	1,776,000	509,000	
SB-5	CHOC BAYOU	0	748,000	0	1,100,000	0	1,144,000	256,000	54,000	256,000	61,000	256,000	69,000	
SB-6	EAST HAVEN	2,751,000	475,000	0	579,000	0	563,000	118,000	10,000	118,000	14,000	118,000	18,000	Based on Facility Plan Information
	DIST 47	2,148,000	858,000	0	1,280,000	0	1,850,000	199,000	38,000	199,000	47,000	199,000	59,000	
SB-7	SOUTH HOUSTON	900,000	254,000	0	220,000	0	154,000	129,000	22,000	129,000	23,000	129,000	24,000	
	Subtotal	21,591,000	15,748,000	14,160,000	19,019,000	0	18,429,000	3,396,000	814,000	4,191,000	951,000	4,191,000	1,077,000	
	Total by Period	37,339,000		33,179,000		18,429,000		4,210,000		5,142,000		5,268,000		
	Amortized Capital Cost							3,084,000		5,825,000		7,347,000		
	Total Annual Cost							7,294,000		10,967,000		12,615,000		
	Cost/1000 gal							$.24		$.32		$.32		

Notes: 1) See Table V-14 for construction actions required

2) Capital costs amortized at 7½% over 30 years

3) Costs based on 1975 dollars.

TABLE V-16
VINCE, HUNTING, AND CARPENTERS BAYOUS
SCHEDULE OF PROJECTED CONSTRUCTION NEEDS

Geographical Planning Area	Plant Or Service Area	Existing Capacity Treatment Level	Projected Construction Needs			Estimated Dry Weather Flow/ Total Capacity Available (MGD)				Comments
			1977-1983	1984-1990	1991-1995	1977	1983	1990	1995	
VB-1	Pasadena 1A Pasadena 1B	3.0/2 4.0/2	Collect - 1360	Collect - 1190	Collect - 850	6.2/7.0	6.8/7.0	6.9/7.0	7.0/7.0	Based on Facility Plan projections.
					Total Flow Capacity	6.2/7.0	6.8/7.0	6.9/7.0	7.0/7.0	
HB-1	Homestead	0.88/2	Expand to 3.0/2 Collect - 1900	Collect - 4000	Collect - 2800	1.9/0.88	2.0/3.0	2.4/3.0	2.7/3.0	Based on preliminary Facility Plan information.
HB-2	FWSD 17	1.5/2	Collect - 500	Collect - 900	Collect - 1200	0.77/1.5	0.81/1.5	0.91/1.5	1.0/1.5	Based on preliminary Facility Plan information.
	Jacinto City	3.75/2	-	-	-	1.25/3.75	1.25/3.75	1.26/3.75	1.26/3.75	
	Galena Park 2	0.1/2	Collect - 100	Collect - 100	Collect - 100	0.04/0.1	0.05/0.1	0.06/0.1	0.07/0.1	
					Total Flow Capacity	4.0/6.2	4.1/8.4	4.6/8.4	5.0/8.4	
CB-1	HC FWSD 6	0.07/2	New plant at 0.2/2 Collect - 460	Collect - 370	Collect - 230	0.14/0.07	0.16/0.2	0.18/0.2	0.2/0.2	Based on Facility Plan information.
	FWSD 47	0.6/2	-	-	-	0.36/0.6	0.36/0.6	0.36/0.6	0.36/0.6	
	Jacinto Port N.	0.05/2	-	-	-	0.003/0.05	0.003/0.05	0.003/0.05	0.003/0.05	
	Jacinto Port S.	0.05/2	-	-	-	0.001/0.05	0.001/0.05	0.001/0.05	0.001/0.05	
	FWSD 51	1.0/2	Collect - 1300	Collect - 100	Collect - 100	0.42/1.0	0.61/1.0	0.62/1.0	0.63/1.0	
					Total Flow Capacity	0.92/1.8	1.1/1.9	1.2/1.9	1.2/1.9	

Notes: 1) Existing Capacity/Treatment Level based on information provided by the municipal inventory (Activity 3) or Facility Plans.
2) See Table V-17 for costs.

TABLE V-17
VINCE, HUNTING, AND CARPENTERS BAYOUS
ESTIMATED COSTS OF WASTEWATER TREATMENT

Geographical Planning Area	Plant or Service Area	Estimated Capital Costs						Estimated Annual Operation and Maintenance Costs						Comments
		1977-1983		1984-1990		1991-1995		1977-1983		1984-1990		1991-1995		
		Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	
VB-1	PASADENA 1A PASADENA 1B	0	299,000	0	262,000	0	187,000	242,000	102,000	242,000	104,000	242,000	105,000	
	Subtotal	0	299,000	0	262,000	0	187,000	242,000	102,000	242,000	104,000	242,000	105,000	
	Total by Period	299,000		262,000		187,000		344,000		346,000		347,000		
	Amortized Capital Cost							25,000		46,000		62,000		
	Total Annual Cost							369,000		392,000		409,000		
	Cost/1000 gal							$.16		$.16		$.16		
HB-1	HOMESTEAD	1,801,000	418,000	0	770,000	0	726,000	200,000	28,000	200,000	33,000	200,000	38,000	Treatment costs based on facility plan information
HB-2	FWSD 17	0	110,000	0	198,000	0	264,000	102,000	11,000	102,000	13,000	102,000	14,000	Treatment costs based on facility plan information
	JACINTO CITY	0	0	0	0	0	0	167,000	14,000	167,000	14,000	167,000	14,000	
	GALENA PARK	0	22,000	0	22,000	0	22,000	38,000	1,000	38,000	1,000	38,000	1,000	
	Subtotal	1,801,000	550,000	0	990,000	0	1,288,000	507,000	54,000	507,000	61,000	507,000	67,000	
	Total by Period	2,351,000		990,000		1,288,000		561,000		568,000		574,000		
	Amortized Capital Cost							194,000		276,000		382,000		
	Total Annual Cost							755,000		844,000		956,000		
	Cost/1000 gal							$.51		$.53		$.55		
CB-1	HCFWSD 6	624,000	55,000	0	44,000	0	35,000	61,000	3,000	61,000	3,000	61,000	3,000	
	FWSD 47	0	0	0	0	0	0	68,000	5,000	68,000	5,000	68,000	5,000	
	JACINTO PORT NORTH	0	0	0	0	0	0	33,000	0	33,000	0	33,000	0	
	JACINTO PORT SOUTH	0	0	0	0	0	0	33,000	0	33,000	0	33,000	0	
	FWSD 51	0	286,000	0	220,000	0	220,000	81,000	11,000	81,000	11,000	81,000	11,000	
	Subtotal	624,000	341,000	0	264,000	0	255,000	276,000	19,000	276,000	19,000	276,000	19,000	
	Total by Period	965,000		264,000		255,000		295,000		295,000		295,000		
	Amortized Capital Cost							80,000		102,000		123,000		
	Total Annual Cost							375,000		397,000		418,000		
	Cost/1000 gal							$1.02		$.95		[illegible]		

Note: 1) Table V-16 for construction actions required
2) Capital costs amortized at 7% over 30 years
3) Costs based on 1975 dollars.

TABLE V-18
GREENS/HALLS BAYOU
SCHEDULE OF PROJECTED CONSTRUCTION NEEDS

Geographical Planning Area	Plant Or Service Area	Existing Capacity Treatment Level	Projected Construction Needs 1977-1983	1984-1990	1991-1995	Estimated Dry Weather Flow/ Total Capacity Available (MGD) 1977	1983	1990	1995	Comments
GHB-1	WCID 109	1.25/2	Collect - 1880	Collect - 1650	Collect - 1180	0.29/1.25	0.4/1.25	0.6/1.25	0.74/1.25	
	HC MUD 11	0.25/2	Collect - 680	Collect - 600	Collect - 430	0.05/0.25	0.1/0.25	0.16/0.25	0.2/0.25	
GHB-2	Urban Utility	0.2/2	-	-	Abandon Plant	0.03/0.2	0.03/0.2	0.03/0.2	0.0/0.0	
	North Forest	0.3/2	Collect - 280	Collect - 250	Collect - 180	0.27/0.3	0.3/0.3	0.32/0.3	0.34/0.3	
	Fallbrook UD	1.0/2	Collect - 80	Collect - 70	Collect - 50	0.24/1.0	0.25/1.0	0.26/1.0	0.27/1.0	
GHB-3	HC MUD 5	0.3/2	Collect - 1100	Collect - 950	Expand to 0.36/2 Collect - 680	0.12/0.3	0.2/0.3	0.3/0.3	0.36/0.36	
	Colonial Hills	0.18/2	-	-	Abandon Plant	0.08/0.18	0.08/0.18	0.08/0.18	0.0/0.0	
	HC FWSD 45	0.05/2	Expand to 0.13/2 Collect - 360	Collect - 320	Collect - 230	0.04/0.05	0.07/0.13	0.1/0.13	0.13/0.13	
	Imperial Valley	0.7/2	Collect - 1560	Collect - 1370	Collect - 980	0.27/0.7	0.4/0.7	0.53/0.7	0.63/0.7	
	West Rd. UD	1.55/2	Collect - 2400	Collect - 2100	Collect - 1500	0.96/1.55	1.13/1.55	1.35/1.55	1.57/1.55	
	Northgate	0.75/2	Collect - 140	Collect - 120	Collect - 90	0.17/0.75	0.22/0.75	0.27/0.75	0.31/0.75	
	Western Home	0.08/2	-	-	Abandon Plant	0.01/0.08	0.01/0.08	0.01/0.08	0.0/0.0	
	Sequoia ID	0.04/2	-	Abandon Plant	-	0.03/0.04	0.01/0.04	0.0/0.0	0.0/0.0	
GHB-4	North Belt UD	0.2/2	-	-	-	0.001/0.2	0.001/0.2	0.001/0.2	0.001/0.2	
	Marek Rd. (Blue Bell)	0.3/2	-	-	Abandon Plant	0.04/0.3	0.04/0.3	0.04/0.3	0.0/0.0	
	Heatherglen	0.5/2	-	-	Abandon Plant	0.19/0.5	0.19/0.5	0.19/0.5	0.0/0.0	
	Melrose Park	5.0/2	-	-	Abandon Plant	0.18/5.0	0.18/5.0	0.18/5.0	0.0/0.0	
	Northline Terr	0.3/2	-	-	Abandon Plant	0.26/0.3	0.26/0.3	0.26/0.3	0.0/0.0	
	Willow Run	0.5/2	-	-	Abandon Plant	0.29/0.5	0.29/0.5	0.29/0.5	0.0/0.0	
	Hidden Valley	0.17/2	Expand to 0.27/2	-	Abandon Plant	0.27/0.17	0.27/0.27	0.27/0.27	0.0/0.0	
GHB-5	Intercontinental	0.6/2	Collect - 510	Collect - 450	Collect - 320	0.37/0.6	0.43/0.6	0.54/0.6	0.62/0.6	
	Hunters Glen MUD	0.1/2	-	Collect - 80	-	0.02/0.1	0.02/0.1	0.02/0.1	0.02/0.1	
GHB-6	Douglas Util Co.	0.1/2	-	-	Abandon Plant	0.08/0.1	0.04/0.1	0.01/0.1	0.0/0.0	
	Oakwild	0.49/2	-	-	Abandon Plant	0.23/0.49	0.23/0.49	0.23/0.49	0.0/0.0	
	HC WCID 76	0.25/2	-	-	Abandon Plant	0.24/0.25	0.14/0.25	0.03/0.25	0.0/0.0	
	Easter Oaks	0.05/2	Abandon Plant	-	-	0.18/0.05	0.0/0.0	0.0/0.0	0.0/0.0	Abandon to North Belt in 1978
	HC WCID 74	0.75/2	-	-	-	0.73/0.75	0.73/0.75	0.73/0.75	0.73/0.75	
	Humble SW	1.5/2	Collect - 180	Collect - 160	Collect - 120	0.18/1.5	0.19/1.5	0.21/1.5	0.22/1.5	
	High Meadow	1.0/2	-	-	Abandon Plant	0.41/1.0	0.41/1.0	0.41/1.0	0.0/0.0	
	WCID 69	0.68/2	Collect - 920	Collect - 810	Collect - 580	0.37/0.68	0.47/0.68	0.59/0.68	0.68/0.68	No information on existing plant provided in inputs. Capacity/Treatment level assumed adequate
					Total Flow/Capacity					

(Continued on following page)

Notes: 1) Existing Capacity/Treatment Level based on information provided by the municipal inventory (Activity 3) or Facility Plans.
2) See Table V-19 for costs.

TABLE V-18 (CONT'D)
GREENS/HALLS BAYOU
SCHEDULE OF PROJECTED CONSTRUCTION NEEDS

Geographical Planning Area	Plant Or Service Area	Existing Capacity Treatment Level	Projected Construction Needs			Estimated Dry Weather Flow/ Total Capacity Available (MGD)				Comments
			1977-1983	1984-1990	1991-1995	1977	1983	1990	1995	
GHB-6 (Continued)	Greenwood Village	0.23/2	-	-	Abandon Plant -	0.13/0.23	0.13/0.23	0.13/0.23	0.0/0.0	
	Atascocita Shores	0.1/2	-	-	-	0.05/0.1	0.05/0.1	0.05/0.1	0.05/0.1	
	Atascocita	0.3/2	-	-	-	0.001/0.3	0.001/0.3	0.001/0.3	0.002/0.3	
	Trail of the Lakes	0.1/2	-	-	Abandon Plant -	0.02/0.1	0.02/0.1	0.02/0.1	0.0/0.0	
	El Dorado PUD	0.25/2	-	-	Abandon Plant -	0.05/0.25	0.05/0.25	0.05/0.25	0.0/0.0	
	Greenwood UD	0.35/2	Collect - 840	Collect - 730	Collect - 520	0.17/0.35	0.26/0.35	0.34/0.35	0.4/0.35	
	Royal Wood	0.5/2	-	-	Abandon Plant -	0.47/0.5	0.47/0.5	0.47/0.5	0.0/0.0	
	Hunterwood Village	0.06/2	-	-	Abandon Plant -	0.05/0.06	0.05/0.06	0.05/0.06	0.0/0.0	
	Redwood Est.	0.13/2	-	-	Abandon Plant -	0.01/0.13	0.01/0.13	0.01/0.13	0.0/0.0	
	North Belt	-	New plant at 1.0/2 Collect - 5160	Collect - 4520	Expand to 1.4/2 Collect - 3230	0.0/0.0	0.56/1.0	1.05/1.0	1.4/1.4	
	Reinheart Bayou	-	New plant at .04/2 Collect - 80	Collect - 70	Collect - 50	0.0/0.0	0.02/0.04	0.03/0.04	0.04/0.04	
GHB-7	FWSD 23	5.0/2	Collect - 3420	Collect - 3330	Collect - 2730	3.4/5.0	3.8/5.0	4.1/5.0	4.4/5.0	
GHB-8	Red Gulley	0.9/2	Collect - 810	Collect - 920	Collect - 820	0.27/0.9	0.36/0.9	0.46/0.9	0.56/0.9	GHB-7 through GHB-9 based on Facility Plan information. GHB-9 includes diversion from Dist. 20 and 32
GHB-9	Northeast	2.0/2	Expand to 11.0/2 Collect - 17,000	Collect - 17,000	Collect - 15,300	2.2/2.0	5.1/11.0	6.9/11.0	8.5/11.0	
					Total Flow/Capacity	13.4/29.1	18.0/39.2	21.7/39.2	13.5/29.2	

Notes: 1) Existing Capacity/Treatment Level based on information provided by the municipal inventory (Activity 3) or Facility Plans.

2) See Table V-19 for costs.

TABLE V-19
GREENS/HALLS BAYOU
ESTIMATED COSTS OF WASTEWATER TREATMENT

Geographical Planning Area	Plant or Service Area	Estimated Capital Costs						Estimated Annual Operation and Maintenance Costs						Comments
		1977-1983		1984-1990		1991-1995		1977-1983		1984-1990		1991-1995		
		Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	Treat	Collect	
GHB-1	WCID 109	0	414,000	0	363,000	0	260,000	93,000	8,000	93,000	10,000	93,000	12,000	
	HC MUD 11	0	150,000	0	132,000	0	95,000	52,000	1,000	52,000	2,000	52,000	3,000	
	URBAN UTILITY	0	0	0	0	0	0	47,000	500	47,000	500	0	500	
GHB-2	NORTH FOREST	0	62,000	0	55,000	0	40,000	54,000	2,000	54,000	2,000	54,000	2,000	
	FALL BROOK UD	0	18,000	0	15,000	0	11,000	81,000	500	81,000	500	81,000	500	
	HC MUD 5	0	242,000	0	209,000	300,000	150,000	54,000	2,000	54,000	4,000	57,000	5,000	
GHB-3	COLONIAL HILLS	0	0	0	0	0	0	46,000	1,000	46,000	1,000	0	1,000	
	HC FWSD 45	330,000	80,000	0	70,000	0	51,000	41,000	2,000	41,000	2,000	41,000	3,000	
	IMPERIAL VALLEY	0	343,000	0	301,000	0	216,000	71,000	5,000	71,000	7,000	71,000	8,000	
	WEST RD	0	528,000	0	462,000	0	330,000	105,000	9,000	105,000	12,000	105,000	15,000	
	NORTHGATE	0	31,000	0	26,000	0	20,000	74,000	1,000	74,000	1,000	74,000	1,000	
	WESTERN HOME	0	0	0	0	0	0	36,000	2,000	36,000	2,000	0	2,000	
	SEQUOIA ID	0	0	0	0	0	0	31,000	1,000	0	1,000	0	1,000	
	NORTH BELT UD	0	0	0	0	0	0	47,000	500	47,000	500	47,000	500	
GHB-4	MAREK RD (BLUE BELL)	0	0	0	0	0	0	54,000	500	54,000	500	0	500	
	HEATHERGLEN	0	0	0	0	0	0	65,000	3,000	65,000	3,000	0	3,000	
	MELROSE PARK	0	0	0	0	0	0	199,000	3,000	199,000	3,000	0	3,000	
	NORTHLINE TERR	0	0	0	0	0	0	54,000	4,000	54,000	4,000	0	4,000	
	WILLOW RUN	0	0	0	0	0	0	65,000	4,000	65,000	4,000	0	4,000	
	HIDDEN VALLEY	360,000	0	0	0	0	0	53,000	4,000	53,000	4,000	0	4,000	
GHB-5	INTERCONTINENTAL	0	112,000	0	99,000	0	70,000	68,000	2,000	68,000	3,000	68,000	3,000	
	HUNTERS GLEN MUD	0	0	0	18,000	0	0	38,000	500	38,000	500	38,000	500	
GHB-6	DOUGLAS UTIL CO	0	0	0	0	0	0	38,000	2,000	38,000	2,000	0	2,000	
	OAKWILD	0	0	0	0	0	0	65,000	3,000	65,000	3,000	0	3,000	
	HC WCD 76	0	0	0	0	0	0	52,000	5,000	52,000	5,000	0	5,000	
	EASTEX OAKS	0	0	0	0	0	0	0	1,000	0	1,000	0	1,000	
	HCWCID 74	0	0	0	0	0	0	74,000	7,000	74,000	7,000	74,000	7,000	
	HUMBLE SW	0	40,000	0	35,000	0	27,000	104,000	1,000	104,000	2,000	104,000	2,000	
	HIGH MEADOW	0	0	0	0	0	0	81,000	6,000	81,000	6,000	0	6,000	
	WCID 69	0	202,000	0	178,000	0	128,000	71,000	15,000	71,000	16,000	71,000	17,000	
	GREENWOOD VILL	0	0	0	0	0	0	50,000	2,000	50,000	2,000	0	2,000	
	ATASCOCITA SHORES	0	0	0	0	0	0	38,000	500	38,000	500	38,000	500	
	ATASCOCITA	0	0	0	0	0	0	54,000	1,000	54,000	1,000	54,000	1,000	
	TRAIL OF THE LAKE	0	0	0	0	0	0	38,000	500	38,000	500	0	500	
	EL DORADO PUD	0	0	0	0	0	0	52,000	1,000	52,000	1,000	0	1,000	
	GREENWOOD UD	0	185,000	0	161,000	0	114,000	57,000	3,000	57,000	4,000	57,000	5,000	
	ROYAL WOOD	0	0	0	0	0	0	65,000	7,000	65,000	7,000	0	7,000	
	HUNTERWOOD VILL	0	0	0	0	0	0	34,000	500	34,000	500	0	500	
	REDWOOD EST	0	0	0	0	0	0	41,000	1,000	41,000	1,000	0	1,000	
	NORTH BELT	1,056,000	1,135,000	0	994,000	696,000	711,000	81,000	8,000	81,000	15,000	97,000	19,000	
	REINHEART BAYOU	264,000	500	0	500	0	500	31,000	500	31,000	500	31,000	500	
GHB-7	FWSD 23	0	752,000	0	733,000	0	601,000	276,000	55,000	276,000	60,000	276,000	65,000	
GHB-8	RED GULLY	0	178,000	0	202,000	0	180,000	66,000	5,000	66,000	6,000	66,000	7,000	
GHB-9	NORTHEAST	14,020,000	1,740,000	0	3,740,000	0	3,370,000	560,000	71,000	560,000	96,000	560,000	119,000	Treat O&M based on Fac. Plan info Treat costs based on Fac. Plan Info includes Dist 20 & 32 diversions.
	Subtotal	16,030,000	8,212,000	0	7,793,000	996,000	6,374,000	2,724,000	252,000	2,693,000	307,000	2,009,000	148,000	
	Total by Period	24,242,000		7,793,000		7,370,000		2,976,000		3,000,000		2,357,000		
	Amortized Capital Cost							2,002,000		2,646,000		1,255,000		
	Total Annual Cost							4,978,000		5,646,000		5,612,000		
	Co[illegible]00 gal							$.87		$.78		$.87		

1) [illegible] Table V-18 for construction actions required
2) [illegible] costs amortized at 7% over 30 years.
3) [illegible] based on 1975 dollars.

In the final time period, 1991-1995, projected new facilities include:

1) Five plant expansions increasing total capacity by approximately 7.3 MGD.

2) New collection facilities with capacity for an additional 190,600 persons.

The associated estimated costs for capital expenses and annual operational and maintenance expenses are summarized in Table V-20. Also included in the Table is an estimate for the total cost per 1,000 gallons for treatment of wastewater based on average daily dry weather flow during the time period.

TABLE V-20

SUMMARY OF ESTIMATED COSTS*
OTHER TRIBUTARY BAYOUS

Period	Capital Cost (Total)	O & M Cost (Annual Avg.)	Total Cost** ($/1,000 Gallons)
1977 - 1983	105,000,000	13,000,000	0.16 - 1.02
1984 - 1990	62,000,000	14,000,000	0.16 - 0.95
1991 - 1995	50,000,000	14,000,000	0.16 - 0.95

* Costs based on 1975 dollars
** Varies among watersheds.

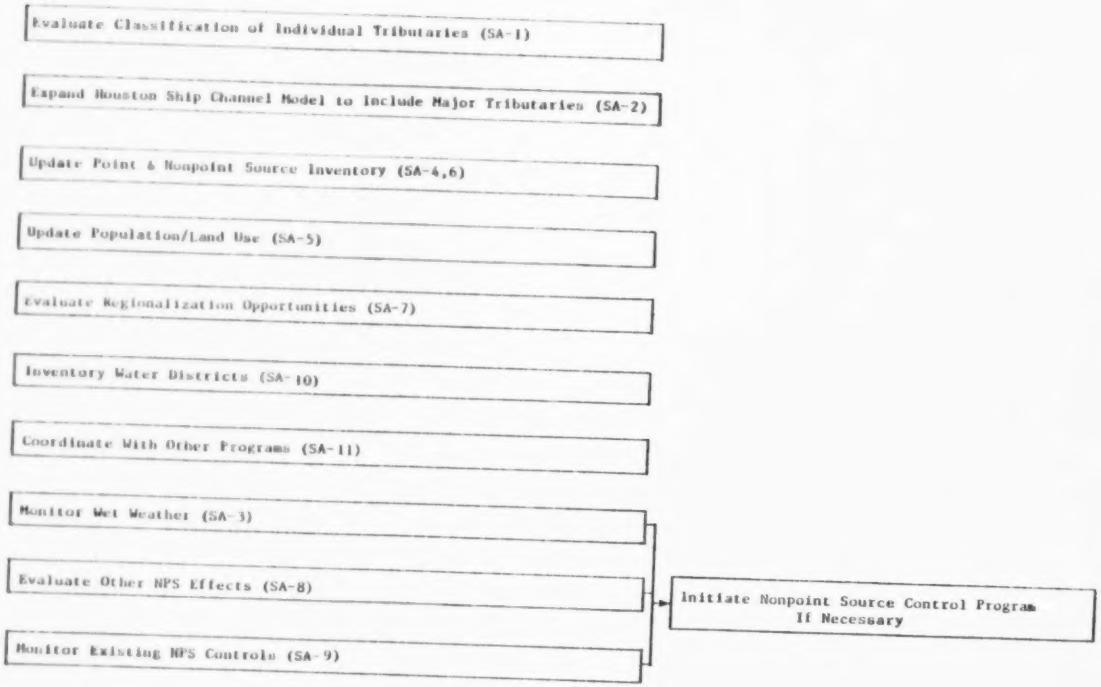
Action Checklist

Items required to implement the 208 plan in the tributary bayou areas have been identified in this chapter. Figure V-4 presents the interrelationships between activities, decisions, and ongoing planning efforts. Special activities (SA) identified in the figure refer to those previously described. Priorities and further definition for the special activities was presented in Chapter II.

FIGURE V-4

INTERRELATIONSHIP OF IMPLEMENTATION REQUIREMENTS

OTHER TRIBUTARIES


Evaluate Classification of Individual Tributaries (SA-1)
Expand Houston Ship Channel Model to Include Major Tributaries (SA-2)
Update Point & Nonpoint Source Inventory (SA-4,6)
Update Population/Land Use (SA-5)
Evaluate Regionalization Opportunities (SA-7)
Inventory Water Districts (SA-10)
Coordinate With Other Programs (SA-11)
Monitor Wet Weather (SA-3)
Evaluate Other NPS Effects (SA-8)
Monitor Existing NPS Controls (SA-9)
Initiate Nonpoint Source Control Program If Necessary

CHAPTER VI FINANCING OF POINT SOURCE CONTROLS

CHAPTER VI

FINANCING OF POINT SOURCE CONTROLS

Houston 208 Financial Options[1]

The availability of sufficient funds to finance the recommended 208 water quality activities is a critical concern in developing the implementation recommendations. Section 208 (b) (2) (E) of the Federal Water Pollution Control Act Amendments requires that water quality management plans identify "measures necessary to carry out the plan (including financing) . . . ". Simply put, adequate financing is a prerequisite to undertaking the point source pollution control actions recommended and therefore understanding the financing alternatives is a prerequisite to implementing the water quality management plan.

Finance, however, is only one of the water quality management functional groupings which were studied in the 208 program. Furthermore, the financial arrangements to implement the plan must be developed in accordance with the recommended management/institutional structure and the authority and duties of the operating agencies as required by P.L. 92-500.

In the Houston 208 plan, the management recommendation for design and construction of treatment facilities, the long term operations and maintenance, and the finance of these facilities is for the "continuation and the coordination of the present management system". Existing managing and operating agencies will thus continue to be responsible for financing, constructing and maintaining wastewater treatment plants. Specifically, the City of Houston, San Jacinto River Authority and the Gulf Coast Waste Disposal Authority will continue to provide wastewater treatment services. Other cities and existing special purpose districts will also continue as management and operating agencies responsible for constructing and operating treatment plants.

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1. This discussion includes information on public finance and 208 planning in the Environmental Protection Agency, Financial Arrangements for Water Quality Management Planning, Draft, Tech. 22, October 1976.

Finance also will continue to be a tripartite function shared by the federal government, the Texas Department of Water Resources and local government units. At this point the various options available to these government units to finance these plants and the limitations on these powers must be examined. Among these tools are grants from various federal agencies, loans from the state government and municipal bonding tools and assessment methods.

Federal Grants

Intergovernmental grants from the federal government to local municipalities and sewer districts play a significant role in the financing of waste treatment facilities. The major portion of federal funds for these projects is in the 201 Construction Grants Program. Under this program, the U.S. Environmental Protection Agency makes grants for up to 75 percent of the planning and construction costs for new municipal sewage treatment facilities. The Texas Department of Water Resources is responsible for distributing the funds at the local level, after developing a prioritization of State waste treatment projects.

EPA is also able to guarantee loans to local communities which are unable to raise funds on their own for wastewater facilities. A 1976 amendment to the Federal Water Pollution Control Act established a loan guarantee program for construction of treatment facilities. The EPA Administrator is authorized to guarantee loans made by the Federal Financing Bank to EPA grantees to finance the local share of construction costs of treatment works. The Administrator must certify that the grantee cannot obtain sufficient credit on reasonable terms as determined by the Secretary of the Treasury. A reasonable assurance of repayment is also required.

Local communities are also permitted to use their Community Development Block Grant funds from the Department of Housing and Urban Development for collection facilities but not for wastewater treatment. These grants are allocated to local government units through a formula based on population, overcrowded housing and the poverty level.

The Farmers Home Administration (FmHA) makes grants and loans to communities less than 10,000 people. Agency policy restricts use of funds to rural counties. FmHA funds can be used for capital construction including new treatment plants and collection systems. Grants may cover up to 50 percent of project construction costs while loans can be issued to cover up to 100 percent of the capital costs. The agency is also permitted to make grants to financially needy communities to reduce average user costs to an amount equivalent to 1 percent of annual median family income.

Funds are also available from the Economic Development Administration to economically depressed areas of the country for the purposes of stimulating economic growth and development and to create jobs. Counties, municipalities and particular sections of cities can all be designated by EDA as being "economically distressed". This designation makes an area eligible for economic development funds. Various types of assistance are available under several EDA programs. Grants are now being made for wastewater projects and storm water collection systems under the Public Works Impact Area program. These grants, however, are primarily for small areas and are limited to $500,000.

EDA is precluded from funding those projects for which EPA is providing assistance. Projects which have low priority for EPA funds may qualify for EDA grants. Grants for wastewater facilities would most readily be made by EDA to economically distressed areas in which an industry seeks to relocate but is prevented from doing so by the lack of sewer facilities. Galveston County has been designated as a redevelopment area and Waller and Liberty counties have qualified for funds although they are not formally designated at this time.

Many capital investment projects cannot be undertaken without the use of federal grants. The costs involved in planning, designing, and constructing secondary level treatment facilities are often monumental. Substantial costs are incurred for small plants and collection systems, though economics of scale allow for some cost savings as the size of the plant increases. EPA presently provides grants for up to 75 percent of the construction costs of wastewater treatment facilities. Without these grants many communities simply could not afford to build new or expanded sewer plants and lines. Intergovernmental grants for capital facilities provide smaller areas, many of which lack the necessary financial resources, with the capabilities to provide needed services and to achieve national objectives and requirements.

In general, grants have not been made available for the day-to-day operation of water treatment facilities, except where such programs fall into an experimental area. The major advantage associated with the use of grants is that grants provide a source of funds external to the area, and as a result, do not impact the local tax base or government credit. It is important to note that intergovernmental grants are not always available due to the competition for limited funds and program changes. In addition special regulations may apply to facilities constructed with federal grants and restrictions are placed on how the funds are used. Finally, difficulties in application and approval procedures may create unacceptable delays in project development.

Despite the limitations and disadvantages sometimes associated with federal grants, in most cases local treatment works could not be built without the intergovernmental subsidy to the capital costs of constructing these facilities.

The State

It is the State's function to allocate Texas' portion of federal funds for wastewater treatment facilities to the various projects throughout the State. The Texas Water Quality Board, which has been incorporated in the Texas Department of Water Resources, coordinates the federal 201 Construction Grants program. The Board is responsible for creating the priority list which controls the disbursement of construction grants. Priority lists are prepared for each basin with the specific ranking being determined by a methodology developed by the State and approved by EPA. The availability of federal grants up to 75 percent of the planning, design and construction costs of a project is critical in the financing of local waste treatment facilities.

The Texas Department of Water Resources plays another critical role in the financing of local facilities through its adminsitration of the State Water Quality Enhancement Fund. The Texas Water Development Board is empowered by Sec. 17.011 of the State Water Code, to provide for the issuance of negotiable bonds in an aggregate amount not to exceed $400 million. The proceeds from the sale of Water Quality Enhancement bonds are deposited in the Water Quality Enhancement account of the development fund and may be used for construction of treatment works.

Section 17.271 provides for the Water Development Board to make loans of Water Quality Enhancement funds to political subdivisions of the state, including cities, counties, districts, for the construction of treatment works. It should be noted that the State does not make grants to local communities for construction projects, but will make loans to cities, counties, municipal utility districts, water improvement districts and other "bodies politic" of the state. Section 17.272 specifies that loan "means purchase by the State of the bonds or other obligation of a political subdivision with water quality enhancement funds."

Section 17.230 provides for direct loans to those political subdivisions that in the judgement of the Board are unable to issue bonds or other obligations. It appears though that the State does not generally utilize this loan-making power at the present time.

The Water Development Board may select those political subdivisions to whom financial assistance may be provided, (Sec. 17.277 (c)), granting the application in whole or in part. The intent of the program is to provide funds to those entities which are unable to sell their bonds in the private investment market at a reasonable interest rate. The Board is required in Section 17.276 to consider: (1) the benefit of the treatment works to water quality needs; (2) the availability of revenue for the ultimate repayment of the cost of the treatment works; (3) the ability of the political subdivision to finance the treatment works without state assistance; (4) the relationship of the treatment works to statewide water quality needs; (5) the relationship of the treatment works to water quality planning for the State. Generally, political subdivisions in the Houston 208 area have been able to sell their bonds in the private investment market, although TWDB has made loans to several local municipal utility districts.

To obtain financial assistance under Section 17 of the Water Code, a political subdivision may issue general obligation, revenue bonds or a combination of bonds for the purpose of constructing treatment works. The Board's lending rate is defined to be .5 percent above its net effective interest rate. The net effective interest rate is defined to be a weighted average of the interest cost on the Board's three most recent bond issues. The Board may specify the terms and conditions of financial assistance, including the development of maturity schedules which are tailored to the individual financial capabilities of the applicants and which achieve the best security for the State.
A political subdivision may sell its bonds to the Board in such amounts as may be determined by the governing body of the political subdivision and approved by the Board. The bonds are valid and binding after approval by the Attorney General, registration by the comptroller and purchase by and delivery to the Board.

Local Financing Tools

Local water quality management entities must have the capabilities to raise sufficient funds for both amortization of long-term capital costs and recurring operating and maintenance costs. Current revenues and funds in capital improvement accounts are generally insufficient to meet the substantial costs associated with construction of large waste treatment facilities. In such instances, communities may pursue bond financing for their capital investment. The discussion below summarizes some basic bonding mechanisms.

A bond is in essence a loan made to the public agency issuing the bond by the institutions (including banks or major corporations) and individuals purchasing the bond. There are two major types of bonds -- general obligation bonds and revenue bonds.

General Obligation Bonds (G. O. Bonds) -- General obligation bonds are secured by the full faith and credit and the financial resources of the issuing political unit. The issuer has the power to levy taxes to repay the principal and interest on the bond. General obligation debt traditionally has been payable from property tax revenues, but other sources of revenue can be applied to the payments.

Since these bonds are backed by the full faith and credit of the community, they can usually command a lower interest rate than other types of bonds. Because of their relative security and general standardization, they are usually highly salable and incur lower administrative costs in the financing of capital facilities. This is because the security is the credit of the community and, as a result, costly market, financial, legal, and engineering reports on specific projects are not as necessary as in the case of the revenue bond.

Although general obligation bonds can be used for almost any type of facility, there are certain disadvantages. The total amount of debt that a community can carry is limited by law as well as by the credit rating of the community. As a result, if debt levels become too high relative to community revenue capability, additional bonds are difficult or expensive to market. In cases where communities have excessive debt or poor credit ratings in the bond markets, it may be possible to obtain better interest rates using revenue bonds associated with a specific project. Because of the fixed limit in general obligation bonds the community may not wish to use a disproportionate share for water quality management to avoid precluding other major capital needs not fundable by other means. Finally, the general obligation bond requires a voter referendum for approval of the issue.

Voters have the option to disallow use of a general obligation issue and as a result may negate the planned financing mechanism for water quality actions.

Revenue Bonds -- Revenue bonds are dependent upon a specific source of revenue. These bonds are backed by a pledge of an expected income stream from tolls, charges or rents paid by those who use the facilities constructed with the proceeds from the bonds. Revenue bonds have no support from ad valorem taxes. Their success and costs depend on the reliability of the projected revenues. Purchasers of revenue bonds demand compensation for additional risk, often requiring higher interest rates, and examine the past performance of the borrower, methods for timely collection of revenues, potential for default, ratio of expected revenues to payment requirements, and provision for increasing charges to meet debt service requirements.

In some cases, these bonds are backed by the full faith and credit of the issuer as well. Such bonds are called combination bonds. In Texas, various types of water districts have unlimited taxing authority which may be used to secure Unlimited Tax and Revenue Bonds. The additional backing minimizes risk and can make the bond more attractive in the bond market. An additional technique is to "cross-pledge" the revenue bonds to an established system to finance the proposed project. This is effective when the existing system has a solid history of revenue generation. For example, the revenues from an existing water supply system would be pledged as security for bonds to build new wastewater treatment facilities. In most cases, this is only permitted when the cross-pledged systems (e.g., water and sewer) are combined systems.

Revenue bonds are commonly used to finance the construction of wastewater treatment facilities. These bonds are one of the most popular finance mechanisms because many authorities and commissions have no other means available for raising capital funds. Moreover, revenue bonds can be used to fund projects when community debt limits have been exceeded and/or when the use of the funds precludes special assessment bonds. From the point of view of water quality management, one of the major advantages to the revenue bond is that revenue bonds are flexible bonding instruments which can be used to finance multi-jurisdictional projects. Revenue bonds are not constrained by the geographic limitations imposed by the tax authority of existing political jurisdictions. Moreover, in cases where existing water pollution control operations have, over time, developed an excellent record of earnings and bond repayment, it may be possible to obtain lower interest rates on revenue bonds than on general obligation bonds.

Revenue bonds may not be marketable or the interest rates may be excessive in cases where there is no record of earnings to be evaluated by potential purchasers. In addition, the bond market may require that revenues be higher than necessary to cover debt service. The amount of coverage (revenue over and above debt) can vary the risk of the issue substantially and, as a result, the interest rate required for sale.

Special Assessment Bonds -- Another tool is the special assessment bond. A special assessment bond is a form of revenue bond supported by the revenues derived from those living in a specific sub-area (watershed, neighborhood, etc.) or who comprise a specific class of user (industries, residences, septic tank users etc.).

The bonds are issued to cover the cost of an improvement directly tied to benefiting property owners. The bonds are repaid by receipts from assessments, apportioned according to direct or indirect benefits of the improvement. This type of financing is commonly used for local area sewers since the benefiting property owners are easily identifiable. In some cases special assessment bonds are not backed by full faith and credit of a governmental unit, and purchasers examine the collection provisions, penalties for unpaid assessments, and the relative status of the assessment as a lien on the property. In other cases, special assessments are backed by the full faith and credit of the issuer and thus provide the same advantage as in a combination general obligation/ revenue bond.

When authority is granted, special assessment bonds can be used by municipalities, special purpose districts, commissions, and other types of public bodies. The major advantage to the special assessment bond is the development of collection facilities that serve a specific subdivision or sub-area. However, because in most cases special assessment bonds are not backed by the full faith and credit of the community investment risk and, therefore, interest are higher, and the marketability of the special assessment bond is lower than a backed issue. To avoid higher interest rates and improve salability of the bonds, subdistricts on occasion will borrow from a municipality issuing general obligation bonds and repay the debt with revenues from a special assessment.

In some cases a community will be able to finance its capital costs for waste treatment facilities out of its general revenues. These funds are public income derived from a wide variety of sources including the ad valorem property taxes and sales taxes, and can be used to pay for a range of public services. The overall concept is based on the idea that the system or program is in force for the public good and that the entire community benefits from the program by (1) having service available and/or (2) having clean water in the case of water quality management.

Financial support for community wastewater systems and treatment facilities has historically been obtained by ad valorem property taxes based on real estate/personal property. The major problems associated with the use of general revenues to finance pollution control are that no distinction is made between major polluters and small or nonpolluters and no distinction is made between beneficiaries and nonbeneficiaries. Another important problem associated with this system is that the total cost burden can be such that, to provide all services, taxes can become so high as to be a burden on the resident property owners. Finally, use of general revenues for operations and maintenance costs of EPA-assisted treatment works does not meet the requirements of Section 204(b)(1)(A) in ensuring that such costs are borne proportionately by the users of the facility.

The operations and maintenance costs of the day-to-day operation of a treatment plant and the recurring repairs that must be made to the system must be paid out of current revenues. The funds to pay the operating and maintenance costs of water quality management can be derived from a wide variety of sources including ad valorem property taxes, user charges, sewer tap-on or connection fees, septic tank permits and industrial waste surcharges. These terms are defined below to provide the reader with a general understanding of the local financing options for wastewater treatment activities. The actual combination of revenue raising tools and assessment techniques can only be determined by each management agency in light of its authorized powers, the financial resources of the service area, existing debt and other demands on its funds as well as the phasing of investments and the projected growth of its service area.

User charges are direct charges made to users of facilities to offset the costs incurred for example, in providing wastewater treatment services. Section 204 of P.L. 92-500 requires that a system of user charges be established for all recipients (residential, industrial, or commercial) to offset the operating and maintenance costs of the treatment works. A schedule of user charges is required prior to federal financial participation in a wastewater management system. The law states that user charges must include at least the operation and maintenance costs of the service provided, relate to flow and be proportionate to each user's share. Operation and maintenance costs must include a provision for replacement costs for plant equipment that must be replaced prior to completion of a treatment facility's service life.

The objective of the user charge system is to distribute the operations and maintenance expenses of wastewater treatment works to the pollutant sources and to promote self-sufficiency with respect to recurring operation and maintenance costs. Under present regulations, debt service costs need not be included in a user charge system and may be apportioned and distributed on the basis of property valuation.

Wastewater service fees determined on the basis of water consumed tend to restrict water usage, especially when rate structures do not offer lower rates for increased consumption. Service fees can financially motivate industries that utilize water for various aspects of production to alter existing systems (for example, to re-engineer flow-through cooling systems so that they become recirculatory systems). Engineering changes result in decreased loadings on the sewerage system, conservation of water resources, and reduction of total treatment costs.

Industrial Cost Recovery, as defined by Section 204(b)(1)(B) of P.L. 92-500, requires recovery from industrial users of publicly owned treatment works of that portion of the Federal grant which relates to the industry's proportionate share of the capital cost of the project.

P.L. 92-500 identifies industrial users in the following divisions:

Division A - Agriculture, Forestry and Fishing
Division B - Mining
Division D - Manufacturing
Division E - Transportation, Communications, Electric, Gas, and Sanitary Services
Division I - Services

The share of the cost attributable to each industrial user is based upon factors contributing to the cost of the treatment works (e.g., volume, strength, delivery flow rate characteristics). Any change in these characteristics necessitates an adjustment of the required annual payments. The cost recovery period for industrial users is 30 years or the useful life of the treatment works, whichever is less.

Half of the funds generated through industrial cost recovery are retained by the applicant. Of this retained amount, four-fifths must be utilized for future plant expansion and construction associated with the project, but one-fifth is discretionary. Availability and use of retained funds should be included in the discussion of financial arrangements for the water quality maintenance plan's implementation. For example, the discretionary portion of retained funds might be utilized to finance continuous planning while the nondiscretionary retained funds would finance a portion of the identified treatment works needs.

Industrial waste surcharges are a specialized form of user charges usually imposed on industries according to the relative cost and difficulty of treating its effluent as part of publicly owned treatment facility. The characteristics of the wastewater determine the cost of treating it; thus whenever the range of concentration for any pollutant source exceeds the normal standards a surcharge is imposed in addition to the basic user charge.

Permits and fees are specialized forms of user charges that usually entail a one-time charge. A common one-time charge is the connection fee collected at the time the user makes a connection to the sewage collection system. Permits and fees can include building permit fees, discharge fees, and so forth.

The intent of permits and fees is two-fold: to generate revenue in accordance to a cost, service, or value of pollution and, by establishing fees that serve as incentives to find alternatives, to control activities that result in undesirable external effects. For instance septic tank permits control the installation and maintenance of individual home treatment systems and serve to limit nonpoint source pollution. Recreational fees represent a social cost of providing the public with safe and clean waterways for play and recreation. Such charges are not based on benefits received but instead reflect actual or potential damage and social costs. Permits and fees can provide a major regulatory tool for local governments and are critical to the development of regulatory programs.

Summary

Table VI-1 summarizes the available financing tools on a Federal, State and Local level as described in this Chapter. Included within the table is a brief description of each item's advantages/disadvantages, the proscribed use of the funds, and the eligibility of local entities for these funds.

The technical plans have proposed five categories of actions for the 208 area. Table VI-2 summarizes the available means of raising required funds for each type of action.

TABLE VI-1

FINANCING TOOLS - HOUSTON 208 MANAGEMENT & OPERATING AGENCIES

Financial Tools	Advantages/ Disadvantages	Use of Funds	Eligibility			
			Gulf Coast	San Jacinto	Cities	Districts[1]
Federal						
Environmental Protection Agency 201 Grants	Primary funding for wastewater treatment. No impact on local tax base or government credit. Use of funds must comply with detailed regulations. Potential bureaucratic red tape.	Capital Construction for new, expanded, or rehabilitated sewage treatment plants, intercepter sewers, sewage collection systems, combined sewer overflow control systems. Up to 75% of costs of planning, designing, and constructing facilities.	*	*	*	*
Economic Development Administration Grants	Available to areas unable to obtain EPA funds.	Industrial related or job-creating portions of facilities only. 50% - 80% grant depending on program area.			*[2]	
Community Development Block Grants (U.S. Dept. of Housing & Urban Development)	Local community determines expenditure of funds. May provide grant for 100% of costs. Not directly concerned with water quality issues. Many competing demands for funds.	Capital construction & acquisition of facilities & equipment for: 1. Solid waste disposal facilities 2. Storm sewers 3. Collection system up to interceptor sewers Assistance up to 100% of costs, determined by local community.			*	

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1. Water Control and Improvement Districts, Municipal Utility Districts, Fresh Water Supply Districts and Special Law Districts.
2. Any economically distressed areas of cities.

TABLE VI-1 (CONT'D)
FINANCING TOOLS - HOUSTON 208 MANAGEMENT & OPERATING AGENCIES

Financial Tools	Advantages/ Disadvantages	Use of Funds	Eligibility			
			Gulf Coast	San Jacinto	Cities	Districts
Federal						
Farmers Home Administration Grants & Loans	Grants & loans to small communities, rural areas. Grants may be used to reduce average user cost.	Capital construction, including purchase of land. Grants up to 50% of eligible costs. Loans up to 100% of project costs.	Areas under 10,000 persons only.			
State						
Water Quality Enhancement Fund Loans	Low interest loans to political subdivisions unable to obtain private capital funds at reasonable terms	Capital construction of treatment works including: planning building acquisition alteration remodeling improvement extension	*	*	*	*
Local						
General Obligation Bonds	Highly salable, potentially lower interest rates than other bonding tools. Bonded indebtedness limited by law. Election requirement -- potential resistance to increased indebtedness and/or tax increase	Capital construction	*	?[3]	*	

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3. Question marks indicate that insufficient data is available to determine agency practice in a particular area.

TABLE VI-1 (CONT'D)
FINANCING TOOLS - HOUSTON 208 MANAGEMENT & OPERATING AGENCIES

Financial Tools	Advantages/ Disadvantages	Use of Funds	Eligibility			
			Gulf Coast	San Jacinto	Cities	Districts
Local						
Revenue Bonds	Greater flexibility. Not a municipal obligation -- not included in debt capacity. Election not always required. Less secure than G.O. Bonds -- sometimes higher interest cost.	Capital construction	*	*	*	*
Unlimited Tax & Revenue Bonds	Secured by unlimited tax authority and facility revenues.	Capital construction				*
Certificates of Obligation	Secured by facility revenues and tax funds. Less secure than General Obligation Bonds.	Capital construction			*	
Special Assessment Bonds[4]	Localized source of capital funds. Constitutionality now in question.	Capital construction	?	?	?	?

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[4] The constitutionality of special assessment bonding in the State of Texas is in question at this time.

TABLE VI-1 (CONT'D)

FINANCING TOOLS - HOUSTON 208 MANAGEMENT & OPERATING AGENCIES

Financial Tools	Advantages/ Disadvantages	Use of Funds	Eligibility			
			Gulf Coast	San Jacinto	Cities	Dis-tricts
Local						
Ad Valorem Taxes	Major source of local revenue. Maximum tax rate limited by law.	Retirement of municipal bonds. In some cases for general administration, O&M.	*[5]	*	*[6]	*
User Charges	Primary source of current revenues. Required by EPA. Distribute costs between persons receiving services.	Generally for current expenses, operations, maintenance, and repairs, and annual debt service.	*	*	*	*
Connection Charges	Requires future users to assume their share of cost as they connect to system.	Capital construction		*	*	*
Fines, Fees, Penalties	Control tools, economic disincentive. Not major source of revenue.	Septic tank permits, recreational fees, licenses, and other local fees and permits.	*	*	*	*

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5. Authority of up to 10¢ per $100 assessed valuation if approved by voters in the region.
6. Home rule cities have authority to tax up to $2.50 per $100 assessed valuation of property. General rule cities have authority to tax up to $1.50 per $100 assessed valuation of property.

TABLE VI-2

FINANCING TOOLS BY PROPOSED ACTIONS

Potential Financing Tools	Proposed Actions				
	Create New Service Area	Expand Existing Plant Facilities	Upgrade Existing Treatment	Develop Major Conveyances	Develop Minor Conveyances
EPA 201 Grants	*	*	*	*	
EDA Grants	*			*	
Community Development Block Grants					*
FmHA Grants and Loans	*			*	
Texas Water Quality Enhancement Loans	*	*	*	*	
General Obligation Bonds	*	*	*	*	*
Revenue Bonds	*	*	*	*	*
Certificates of Obligation	*	*	*	*	*
Special Assessment Bonds					*
Ad Valorem Taxes	*	*	*	*	*
User Charges	*	*	*	*	*
Connection Charges	*				*

CHAPTER VII COORDINATION

CHAPTER VII - COORDINATION

Introduction

This function focuses on input toward implementation of water quality programs at the local level. It provides a forum for communication and coordination between operators, regulatory agencies, interest groups and the planning agency. Activities will include regional water quality policy recommendations, sharing of technical expertise, coordinate implementation of nonpoint programs, recommendation of planning priorities and provide local input to Federal and State programs. The 208 Plan recommends the creation of a local advisory body to fulfill these requirements.

The establishment of a coordination body for water quality programs was the subject of considerable debate at public forums prior to local plan approval. However, the concept of provision of coordination for the 208 planning effort at the local level was endorsed.

Resolutions passed by the Areawide Planning Advisory Committee on April 14, 1978 and the H-GAC Executive Committee on April 18, 1978 state support for the concept of a coordinating entity such as a water quality council but request further study and evaluation of this concept.

Interim Actions

In the period of time between approval of the initial 208 plan and the creation of a local coordination mechanism, the Texas Department of Water Resources will have the responsibility for coordination. It is recommended that the Areawide Planning Advisory Committee continue to provide guidance and local input in accordance with its original charter. The H-GAC, in addition, will continue to provide a vehicle for communication between local governing bodies and will through the A-95 review process, recommend projects in conformance with the Areawide Plan.

Watershed Coordination

A key to long-term implementation of the Greater Houston 208 Plan will be the effectiveness of watershed coordination. The merits of addressing water quality problems on a watershed basis have been demonstrated in the presentation of Technical Subplans.

It is recommended that as part of the coordination function, key area operators would assume primary responsibilities for overseeing what takes place in each watershed.

It is envisioned that the primary activity of a Watershed Coordinator would involve working with municipalities and water districts in preparing applications for Federal funds to aid construction of wastewater treatment facilities (201 Construction Grants Program). The Coordinator can assist in assessing incentives for developing joint waste treatment facilities among neighboring communities. The 208 Plan will be a principal reference in making such evaluations. The evaluations should take place prior to clearinghouse (A-95) review by the H-GAC. A project which conforms with 208 Program recommendations should receive a priority advantage in the State's listing of projects eligible for Federal assistance.

The Watershed Coordinator could also serve as an initial contact for engineers and developers seeking information for project work in a given watershed. This will provide a degree of organization that is presently lacking.

A final and most important function of each Coordinator should be to lead the way in developing corrective, nonpoint source programs in its area of coordination responsibility. This could include (1) providing technical assistance, (2) performing special studies, and (3) assisting in implementing exemplary programs.

CHAPTER VIII   PLANNING REQUIREMENTS

CHAPTER VIII PLANNING REQUIREMENTS

Introduction

The Federal Water Pollution Control Act Amendments of 1972 (FWPCA) mandates three distinctive water quality and land use planning processes: statewide basin planning under section 303 (e), areawide waste treatment planning under section 208 and facilities planning under section 201. However, the FWPCA fails to provide adequate guidance for the interrelationships between the three programs. The framework for this interrelationship has been provided by administrative guidelines and regulations.

Under federal regulations and guidelines, section 303 (e) basin planning serves as a framework for future planning under 201 and 208. Section 303 (e) planning must include consideration of the relationships between 303 (e) planning and other planning processes including section 201 and 208 planning. EPA guidelines require that the total waste load from a 201/208 planning area must be consistent with the applicable basin plan. However, with respect to individual wasteload allocations, compliance schedules, and facility needs assessment, the 201/208 plans will supersede the applicable portion of the basin plan when completed.

Once the basin plan for an area has been approved by the state water quality regulatory agency, the governor and the regional EPA office, no construction grant under the section 201 program that would violate any relevant portion of the basin plan may be approved by EPA. Similarly, EPA may not approve NPDES permits for either industrial or municipal discharges if the discharge would violate the 303 plan.

The requirements of Section 208 are to provide a continuing areawide planning process consistent with Sections 201 and 303 of the Act. After certification of the initial plan by the Governor and approval by the EPA Regional Administrator, the plan must be updated and submitted for certification annually as being consistent with applicable basin plans.

The H-GAC has been recommended as the designated agency to perform the continuing planning process after the initial plan submittal.

The Sections which follow briefly describe the planning activities to be undertaken during the first year of 208 implementation. Some tasks will also be part of the on-going 208 planning program.

Program Coordination

The 208 program from its inception was envisioned to be part of a broader environmental planning program. Initial plan development did comply with this EPA dictate. During the annual update and on-going planning phases of the program, coordination of 208 planning must be maintained with the range of other public programs such as solid waste and air quality responsibility. In addition, the H-GAC staff will provide support services to a water quality council, when formed, and interface with the planning staffs of other governmental agencies.

Initiate Mechanisms for On-going Plan Update

Pursuant to the mandate of P.L. 92-500 the planning staff must be prepared to undertake the process of 208 plan updates. Due to the rapid growth of the Houston region and extent of the 208 plan itself the importance of this activity is readily apparent. This task would encompass not only establishing the update mechanisms from an administrative standpoint but also initiating the technical steps to be undertaken.

Monitoring Population Growth and Land Use Changes

All of the areas planning programs are founded upon basic population and land use data. The 208 program is not an exception, thus a portion of the 208 planning program's budget will be allocated to assuring the accuracy and timeliness of the data base for planning. This effort will be coordinated with demographic activities in other on-going planning efforts such as health and transportation.

Mesh Methodologies for Designated and Non-Designated 208 Areas

It has been recommended that the present 208 area boundaries be altered after the initial implementation of the 208 plan is started. If this recommendation is to be followed, the planning program proposed suggests a careful review of the 208 plans from both the designated sectors and the development of a precise scheme for sychronizing each plan's recommendations. Where such coordination is impossible new bridge-building mechanisms must be developed.

Inventory Updates

As part of the state and regional 208 efforts vast array of existing data developed. This planning task focuses upon the need to further improve the accessibility and extent of the data required for on-going 208 plan monitoring as well as plan updating. This inventory work would build upon the information available in the 208 program as well as that contained in the Texas Research Information System. A wide range of factors such as service areas, point sources and monitoring situations must be augmented and verified as the 208 program progresses over time.

Evaluation of Non-Point Source Strategies

The collection and analysis of the effectiveness of existing non-point source strategies is a critical planning activity. Only in this manner can the questions surrounding the non-point program be resolved. The goal of this activity is to demonstrate the extent and effectiveness of particular non-point mechanisms in order that they may be utilized or built upon in formulating a refined 208 program implementation.

Evaluation of Technical Subplans

As part of the plan updating process an evaluation must be undertaken of the effect of the contents of the updates upon each of the technical subplans. This analysis will highlight changes required in the plans as well as additional planning tasks needed for technical plan alterations which have surfaced in the 208 updating process.

A-95 Review

A portion of the planning staff's time will be devoted to evaluating the impact of A-95 submissions on the 208 program. Thus, this activity is included in the planning budget to defray this additional review process.

Public Participation Program

This section summarizes the Public Participation Program that is proposed to be undertaken by the Houston-Galveston Area Council (H-GAC) in the months following the submittal of the initial 208 Water Quality Management Plan in April of 1978 until the formation of a local coordinating mechanism.

During the interim, H-GAC will be concerned primarily with the first annual update of the initial 208 plan. Since planning activities will not be as intense as in the initial planning phase, a much greater emphasis will be placed on citizen education activities, particularly in the area of nonpoint source pollution awareness. Building on the process that has been established during the initial 3-year planning phase, it will be H-GAC's charge to broaden public awareness and interest in water quality concerns for the next phase of water quality management implementation and planning. The program to be developed, therefore, will be organized into two major functions: advisory committees and the review process, and citizen education.

Advisory Committees and the Review Process

It is recommended that the existing 208 advisory committees continue in their same review and comment activities. Each will be reviewing plan update data and analyses as they become available, and each will continue to advise the H-GAC Staff and Executive Committee as to plan adequacy as it relates to local goals and objectives. Additionally, the committees will be active in the development and implementation of local citizen education programs.

The advisory committees presently functioning are the Areawide Planning Advisory Committee (APAC), the Technical Advisory Committee (TAC) and the Citizens Advisory Group (CAG). The Areawide Planning Advisory Committee (APAC), a group appointed by the Governor, reviews and comments on all planning policies and plan outputs. The Technical Advisory Committee (TAC) was appointed by the H-GAC Executive Committee and charged with the technical analysis of 208 planning elements. The Citizens Advisory Group (CAG) is an open membership group serving as a forum for public review and a means of communication between the lay citizen and the technical planner. These committees will continue to function in their review and comment aspects.

Citizen Education

In addition to the structured review and comment functions provided by the 208 advisory committees, broad-based citizen education and involvement will have a great deal of emphasis during the update phase of the program. Citizen education and activities will be designed to facilitate information distribution and public awareness of water quality problems and goals.

The 208 plan has recommended that a high priority be assigned to assessing the impact of nonpoint source pollutants and the implementation of best management practices. Concurrently, citizen education programs will be established to facilitate public awareness and understanding of nonpoint source pollution and programs.

The general public involvement activities developed in the initial 208 program will be utilized extensively to facilitate the citizen education program. In addition to the informational materials and activities described for nonpoint source awareness, other general program educational materials will be developed and distributed.

A series of public meetings, workshops and seminars will be scheduled for educational purposes. These activities will be used to distribute information relating to the plan update as well as to generate public awareness of water quality concerns, problems and solutions.

Program Administration and Financing

In addition to the specific planning tasks noted above the staff will be required to undertake a variety of administrative tasks related to their planning responsibilities. These tasks will range from project reporting to developing staff work programs. An estimated budget and manpower allocation schedule for planning as well as those related to the establishment of a water quality council is included in Table VIII-1. It should be noted that this breakdown would equal five (5) professional and one (1) technical persons and one (1) administrative support person.

In addition the budget of approximately $300,000 is expected to be raised on a 75% federal/25% local formula basis. The local share could be provided from a variety of sources including local government, H-GAC and possible State funds.

TABLE VIII-1

ESTIMATE OF PLANNING NEEDS FOR FIRST ANNUAL 208 UPDATE

Activity	Approximate Person Months	Approximate Cost, $1,000
1) Program Administration	6	30
2) Coordination with other Programs	3	10
3) Initiate mechanisms for on-going updates	7	25
4) Monitor populations growth, land use changes	3	10
5) Mesh methodologies for designated/non-designated 208*	2.5	10
6) Update inventories	3	10
7) Evaluation of Nonpoint Source Strategies	9	30
8) Evaluate applicability of Technical Subplans	1.5	5
9) Establish Local Coordinating Mechanism (LCM)	6	25
10) Initiate activities (functions) of LCM	6	20
11) Public Participation Program	15	50
12) A-95 Review	3	10
	65	235
Other Direct		60
Travel		5
		$300,000

* Excluding separate contract effort

CHAPTER IX IMPLEMENTATION SCHEDULE AND IMPLEMENTATION ACTIVITIES

CHAPTER IX

IMPLEMENTATION SCHEDULE AND IMPLEMENTATION ACTIVITIES

The timing of actions is an important element of the implementation requirements for the Houston Area 208 Plan. The 208 recommendations will be implemented by a number of agencies and groups of agencies. Existing Federal, State and Local Agencies will continue their functions in such matters as permitting and monitoring. Local Agencies will continue to construct and operate wastewater treatment plants. H-GAC will continue as a planning agency. Local Agency coordination will be effected by a water quality council. Because of the degree of interaction required, an overall schedule is essential.

Figure IX-1 shows the overall schedule for major implementation items. Explanation of various aspects of that Figure are as follows:

1. The nodes have the following associations to time:

   Node A: Immediate 1978-1979.

   Node B: Early in the 1978-1983 time period.

   Node C: Late in the 1978-1983 time period or early in the 1984-1990 time period.

   Node D: During the 1984-1990 time period.

   Node E: During the 1991-1995 time period.

2. For clarity, activities have been divided into elements, denoted by numbers 1 through 9, and subelements, denoted by the number of the element and a sequential numbering of subelements within the element.

3. The start of the activity has been shown as has the approximate length of the activity. Major activity interface has been shown at nodes. However, interface can take place any time the activities are being undertaken concurrently.

FIGURE IX-1

MAJOR IMPLEMENTATION ACTIONS

Number	Element Subelement	Responsibility
1	PERMITS	
1.1	Issue Permits In Accordance With Plan	TDWR/EPA
1.2	Review Permits For Compliance With Plan	Local Agencies Coordinated
1.3	Evaluate New Permit Parameters (Special Studies and Decision Making)	TDWR
1.4	Local Evaluation Of New Permit Parameters	Local Agencies Coordinated
2	MONITORING	
2.1	Continue Existing Primary Monitoring System	TDWR
2.2	Conduct Joint Monitoring Program	TDWR/Local Agencies/Others
2.3	Continue Existing Secondary (i.e.- City of Houston, Harris County etc.) Monitoring Program	Local Agencies/Others
2.4	Establish Mechanism For Coordinating Monitoring	H-GAC/Local Agencies Coordinated
2.5	Conduct Special Monitoring Programs	Many
3	STANDARDS	
3.1	Continue Standards Evaluation (Dry Weather)	TDWR
3.2	Set Standards For Armand And Buffalo Bayous	TDWR
3.3	Evaluate Need For / Set Standards For Other Bayous	TDWR
3.4	Local Input To Standards Setting	Local Agencies Coordinated
3.5	Evaluate/Set Wet Weather Standards (Including Special Studies)	TDWR/Others
3.6	Implement Wet Weather Standards	TDWR

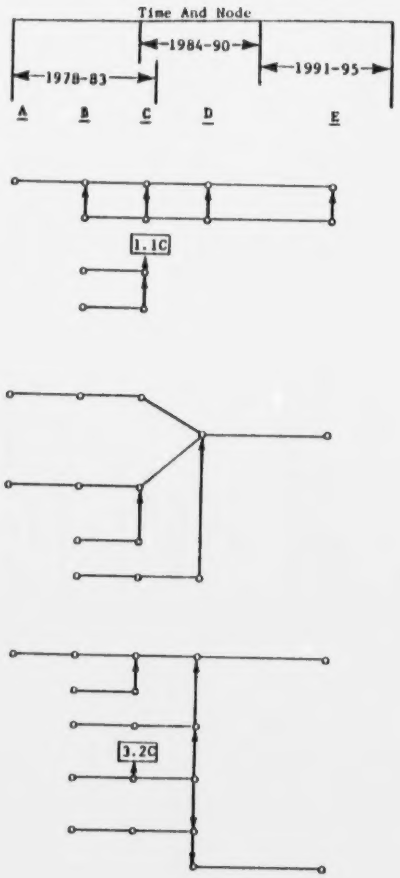


FIGURE IX-1 (CONT'D)

MAJOR IMPLEMENTATION ACTIONS

Number	Element Subelement	Responsibility
4	ENFORCEMENT	
4.1	Strengthen Enforcement Activities	Federal/State/Local
4.2	Coordinate Local Enforcement Activities	Local Agencies
4.3	Develop Enforcement Procedures For Nonpoint Source Program	TDWR
5	WASTELOAD ALLOCATIONS	
5.1	Continue Allocations In Accordance With 208 Plan	TDWR
5.2	Special Studies To Confirm/Modify Allocations	Shared
5.3	Local Evaluation of Allocations	Local Agencies Coordinated
6	FACILITY PLANNING AND CONSTRUCTION	
6.1	Review Facility Plans For Conformance With 208 Plan (A-95)	H-GAC
6.2	Explore Innovative Approaches To Facility Planning For Cost Reduction	Local Agencies Coordinated
6.3	Continue Facility Planning	Local Agencies
6.4	Construct And Upgrade Facilities 1978-1983 $313,560,000* 1984-1990 29,300,000* 1991-1995 15,940,000* * 1975 Dollars	Local Agencies
6.5	Fund Facility Construction	Federal/State/Local
6.6	Continue Priority List And Federal Funding Process	TDWR/EPA
6.7	Assist In Upgrading Local Agency Priority	Local Agencies Coordinated
6.8	Local Evaluation Of Priority Mechanisms/Execution	Local Agencies Coordinated
7	OPERATION AND MAINTENANCE	
7.1	Operate And Maintain Facilities	Local Agencies
7.2	Examine Alternative Approaches To Operation And Maintenance To Achieve Cost Reductions	Local Agencies Coordinated

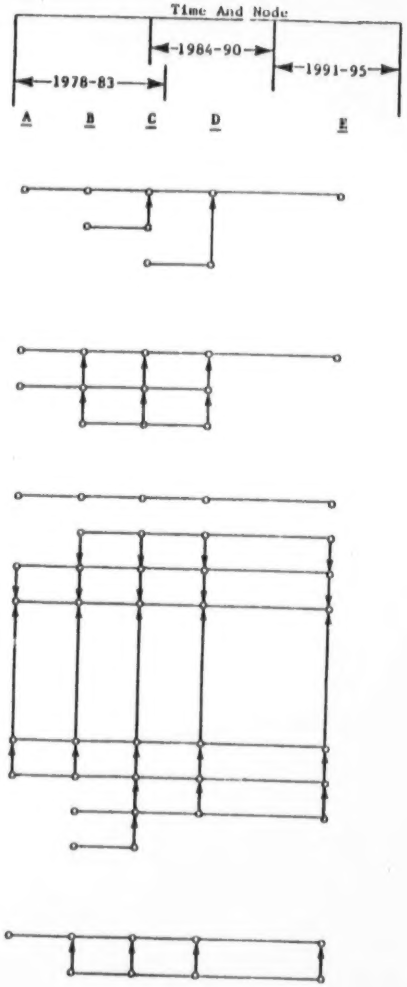
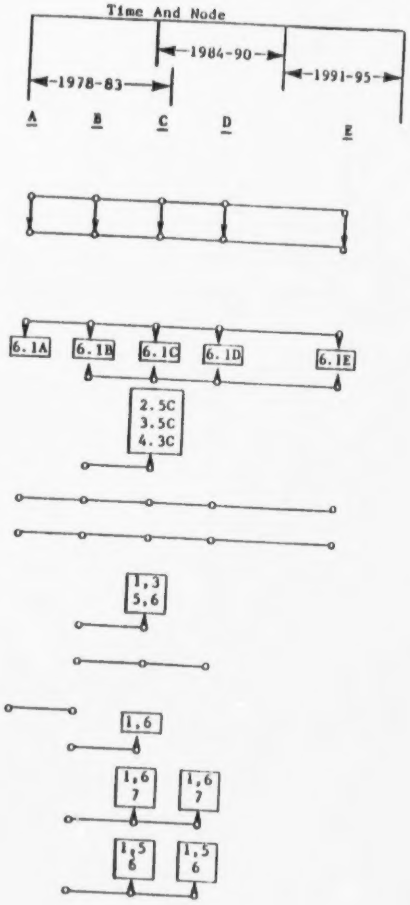


FIGURE IX-1 (CONT'D)

MAJOR IMPLEMENTATION ACTIONS

Number	Element Subelement	Responsibility
8	PLANNING	
8.1	Develop Continuing Funding	Federal/Local
8.2	Conduct First Year Program (Establish Water Quality Council, Combine Designated/Nondesignated Areas, Initiate Update Mechanisms, Continue Public Participation, Select Test Areas) And Provide Annual Plan For Certification	H-GAC
8.3	Conduct A-95 Review	H-GAC
8.4	Update Data Base And Projections	H-GAC
8.5	Review Nonpoint Source Needs	H-GAC
8.6	Interagency Coordination	H-GAC
8.7	Conduct Public Participation	H-GAC And Local Agencies
9	SPECIAL PROGRAMS	
9.1	Develop/Update Water Quality Models	TDWR
9.2	Conduct Special Monitoring Studies	TDWR/Local Agencies
9.3	Test Area Studies (Clear Creek) For Nonpoint Source Controls	H-GAC Selects Local Agencies Implement
9.4	Eutrophication Studies - Lake Houston, Clear Lake, Dickinson Bayou	TDWR/City of Houston
9.5	Impacts Of Miscellaneous Pollutants	TDWR/Local Agencies
9.6	Evaluate Alternative Techniques For Meeting Stream Standards	TDWR/Local Agencies Coordinated



APPENDIX A

LIST OF SPECIAL STUDIES

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Update Steady-State Water Quality Simulation Model

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  Cypress Creek A-3
  Clear Creek A-5
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  Houston Ship Channel and Tributaries A-9
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Map All Water Districts	A-48

Work Element: Update Steady-State Water Quality Simulation Model.

Applicability: Spring Creek

Purpose: Develop a calibrated and verified mechanism to predict water quality and perform wasteload allocations.

Scope: Develop coefficients for steady-state model by expanding existing model coefficients to have separate degradation and/or deoxygenation rates for carbonaceous and nitrogenous BOD.

Inputs:
Existing Modeling Report
Updated Point Source Inventory
Updated Nonpoint Source Wasteloads
TDWR Benthic Demand Methodology
Calibrated Rate Coefficients

Outputs: A calibrated/verified steady-state model which can be used for wasteload allocations including determination of allowable nitrogenous loads.

Suggested Methodology:

The existing calibrated model, developed by TDWR, should be used as a basis. Additional calibration efforts should be made with emphasis in the following areas:

- The degradation of nitrogenous compounds should be tracked to develop a separate rate for these oxygen sinks.
- Benthic demand should be separately measured. Care should be taken relative to the feed back of nitrogenous compounds from benthic deposits so that this sink is not measured twice.
- Creek hydrology should be rigorously defined - 2 year, 7 day low flows plus incremental flow per square mile.
- Efforts should be made to conduct work at approximately low flow conditions since the higher stream carbonaceous compound concentrations may serve to inhibit nitrification.

Timing: The study is required before a firm decision can be made on including an 8 mg/l NH_3-N requirement in the Spring Creek basin discharge permits. The creek is not now in serious jeopardy. Therefore, utilize 2-5 year time frame.

Cost: $30,000 - $40,000

Implementing Agency:

The TDWR is the most suitable agency to conduct this element.

Work Element: Benthic Demand Study

Applicability: Cypress Creek

Purpose: To define the magnitude, source and, if possible, temporary variances of benthic demand. The data will be used in the calibrated steady state model in order to verify effluent quality requirements recommended in the 208 Plan.

Scope: The entire length of Cypress Creek is to be investigated. The magnitude of benthic demand is to be measured directly at several locations in the stream so that a calibrated value of benthic demand can be utilized in the Cypress Creek model. Additionally, sufficient locations should be investigated so that the demand rate can be keyed to upstream conditions and, therefore, estimates can be made of the demand due to:

- Nonpoint Source.
- Point source due to improperly operating plants.
- Point source due to properly operating plants.

In this way, values of demand to be exhibited under future conditions can be estimated.

Inputs:

- 208 Nonpoint Source Analysis
- Steady-State Model for Cypress Creek
- Nonsteady-State Model for Cypress Creek
- TDWR Benthic Demand Methodology (in TDWR Work Plan).
- 208 Point Source Inventory
- Self Reporting Data
- 208 Technical Subplans

Outputs:

- Report Detailing Measured Level of Benthic Demand at Multiple Locations
- Benthic Demand Rates for Steady-State Model Under Existing Conditions
- Comparison of Rates to Those in Initial Model
- Estimated Future Benthic Demand Rates

Suggested Methodology:

The basic method for measuring the benthic demand should be that developed by TDWR for their statewide program. A request for proposal has already been distributed for this work. That methodology should be applied to specific loactions along the Creek. Locations selected should include:

- Stream reaches affected primarily by urban nonpoint source runoff.
- Stream reaches affected primarily by non-urban nonpoint source runoff.
- Stream reaches affected primarily by treatment plants not operating within permit values.
- Stream reaches affected primarily by treatment plants operating within permit values.

At least two hydraulic conditions should be evaluated, after a wet weather period and after a dry weather period when flows are approaching base flows.

The benthic demand should be correlated to upstream conditions. Estimates of future demand, based on projected land uses and treatment plant locations as per the 208 Plan, should be made for several levels of point source treatment (2N and 4N).

Cost: $40,000 - $60,000

Implementing Agency:

TDWR

Timing: This study is required before a firm decision can be made on the need for upgrading along this segment. It should be budgeted for a 2-4 year time frame.

Work Element: Update Steady-State Water Quality Simulation Model.

Applicability: Clear Creek

Purpose: Develop a calibrated and verified mechanism to predict water quality and perform wasteload allocations.

Scope: Calibrate and verify the existing coeficients, rate constants and creek hydrology through field measurements.

Inputs:
Existing Modeling Reports
Updated Point Source Inventory
Updated Nonpoint Source Wasteloads
TDWR Benthic Demand Methodology

Outputs: A calibrated/verified steady-state model which can be used for wasteload allocations.

Suggested Methodology:

The existing calibrated model, developed by TDWR, should be used as a basis for further work. Additional calibration/verification efforts should be made in the following areas:

- Separate degredation/deoxygenation rates for carbonaceous, nitrogenous, and benthic related wasteloads should be evaluated.
- Creek hydrology should be rigorously defined, 2 year, 7 day low flows plus incremental flow per square mile.
- Efforts should be made to conduct work at approximately low flow conditions since wasteload concentrations in the creek may be higher.

Timing: This study is required before a firm decision can be made on the technical subplan for Clear Creek. Technical work indicates potential water quality problems in the present therefore, utilize the 1-2 year time frame.

Cost: $40,000 - $60,000

Implementing Agency:

The TDWR is the most suitable agency to conduct this element.

Work Element: Update Steady-State Model for San Jacinto River.

Applicability: San Jacinto River.

Purpose: To develop a calibrated/verified model for the River to confirm effluent limitations recommended in the 208 Plan.

Scope: Upgrade existing steady state model by developing benthic demand rates and verifying the model. If possible, the San Jacinto model should be incorporated into the Ship Channel model as a branch.

Inputs:
Existing Modeling Report
Updated Point Source Inventory
Updated Nonpoint Source Wasteloads
TDWR Benthic Demand Methodology
Verified Rate Coefficients

Outputs: A calibrated/verified model.

Suggested Methodology:

The existing calibrated/unverified model developed by TDWR should be used as a base. It would be ideal if the San Jacinto model could be tied directly to the Ship Channel model as a branch. If that is not possible, additional calibration efforts on the separate study should be made with emphasis on the following:

- Benthic demand should be measured separately.
- Efforts should be made to define the impact of the Houston Ship Channel on the San Jacinto River for various flow regions in both the Channel and the River.

Implementing Agency:

TDWR

Cost: $20,000 - $30,000

Timing: The needs of the work are not critical. A 5-10 year time frame is appropriate.

Work Element: Develop Steady-State Water Quality Simulation Model.

Applicability: Armand Bayou and Dickinson Bayou

Purpose: Develop a calibrated and verified mechanism to predict water quality and perform wasteload allocations.

Scope: Perform field measurements to develop segment hydrology. Utilize inputs from other models in area for initial rate constants and coeficients.

Inputs:
Updated Modeling Reports (Clear Creek)
Updated Point Source Inventory
Updated Nonpoint Source Wasteloads
TDWR Benthic Demand Methodology

Outputs: A calibrated/verified steady-state model which can be used for wasteload allocations.

Suggested Methodology:

- Special emphasis on segment hydraulics will be necessary due to tidal effects (i.e. boundary conditions).
- Pollutant loadings and oxygen contributions from tidal effects must be evaluated.
- Separate degredation/deoxygenation rates for carbonaceous, nitrogenous, and benthic related wasteloads should be evaluated.

Timing: These studies are required before firm decisions on technical alternatives can be evaluated. These segments are not now in serious jeopardy. Utilize 2-5 year timing.

Cost: $25,000 - $30,000

Implementing Agency:

The TDWR is the most suitable agency to develop the models.

Work Element: Update Steady-State Model for Houston Ship Channel.

Applicability: Houston Ship Channel and Tributaries.

Purpose: Develop a recalibrated/verified model for the Ship Channel and a new model for major tributaries.

Scope: Develop new coefficients for the existing steady-state model to account for pollution abatement obtained since the original model was developed. Extend the model to include several branching tributaries so that the effect of these tributaries on the Ship Channel and the effect of the Ship Channel on the tributaries can be mathematically determined without interface inconsistencies.

Inputs:
Existing Steady-State Model
TDWR Benthic Demand Methodology.
208 Point Source Inventory.
Updated Nonpoint Source Wasteloads,
208 Technical Subplans.

Outputs: A recalibrated, verified steady-state model to include branching tributary analysis of the following Bayous: Buffalo, Brays and Sims. The San Jacinto River could also be included.

Suggested Methodology:

The recalibration/verification of the existing model should emphasize the following areas which are either the subject of controversy and/or are subject to have changes in the time span since the original model development:

- Benthic Demand Rate
- Nitrogenous Degradation Coefficient.

Additionally, the model should be modified so that oxygen resultant from supplemental aeration can be added in a direct manner.

The modeled segment should be extended upstream into Buffalo Bayou to Addicks Reservoir. The major tributaries of Brays and Sims Bayous should also be included in the modeled streams. Branches should be included so that waste inputs from that stream are solved simultaneously with the Ship Channel solution. This is necessary so that the effect of these tributary wasteloads on the Channel accounts for degradation in the tributaries and the quality in the tributaries include the effects of dispersion of Ship Channel waters.

In developing the rate coefficients for the tributaries, the following items are important.

- Analysis should be made at low flow conditions so that dispersion effects are equivalent to those to be encountered for design flows.
- Separate rates for nitrogenous and carbonoceous demand should be developed.
- Creek hydrology, low flow and incremental flow should be defined.

Implementing Agency:

TDWR

Cost: $200,000 - $250,000

Timing: The study is not critical since little immediate action is dependent on its outcome. It should be complete prior to 1983-1985.

Work Element: Monitor Wet Weather Water Quality.

Applicability: Multiple

Purpose: To confirm or contradict existing assumptions of stormwater run-off related affects on segment water quality.

Scope: Implement monitoring network capable of sampling instream water quality versus time for storms of differing magnitude. Compare results with nonsteady-state simulation model predictions where applicable.

Inputs:
Existing Monitoring and Reporting Mechanisms
Existing Nonsteady-State Model
Updated Nonpoint Source Wasteloads
Wet Weather Water Quality Standards (where applicable)

Outputs: A reliable data base which can be used to assess water segment capability of meeting defined wet weather standards. Additional use includes calibration/verification of nonsteady-state model.

Suggested Methodology:

The existing monitoring mechansims and associated entities should be relied upon for development of a coordinated system. Efforts in the following areas should be emphasized.

- The relationship between water quality and time following a storm event.
- Selection of variable monitoring locations in order to identify areas of major wasteload contribution.
- Computer storage of data with capability of statistical analysis.

Timing: This study is required for plan input and updating relative to recommended water quality standards.

Priority will vary with water segment and the relative effect on subbasin recommendations.

- Clear Creek, initiate immediately.
- Houston Ship Channel, initiate during 1-2 year time
- Remaining areas, initiate as resources permit, necessary for plan update.

Cost: $150,000 - $200,000

Implementing Agency:

Existing monitoring mechanisms, coordinated by local agencies, are the most logical implementers of this task. Involvement by the TDWR related to model verification is also desirable.

Work Element: Update or Develop Nonsteady-State Models.

Applicability: Spring and Cypress Creeks, San Jacinto River and Armand and Buffalo Bayous.

Note: These elements are dependent upon the outcome of water quality monitoring. If that monitoring indicates that the model predictions (no wet weather water quality problems) are correct, then these elements (or some of these elements) will not be required. The scope and metholology will be similar to that for Clear Creek with emphasis based on the monitoring data.

Implementing Agency:

TDWR

Timing: Not critical, 5-10 years.

Work Element: Develop Non steady-state Model for Clear Creek.

Applicability: Clear Creek.

Purpose: Develop a calibrated/verified model for both inputs and stream responses under wet weather conditions. This model to be used to determine the degree of nonpoint source control necessary to attain and maintain fishable/swimmable water quality in Clear Creek.

Scope: Develop calibrated/verified model for wet weather wasteloads to Clear Creek Nontidal portion. Wasteloads to be tied to landuses. Develop calibrated/verified model for stream water quality response.

Input:
Existing Non steady-state Model
208 Point Source Inventory
Wet Weather Monitoring Data
Test Area Results
Weather Data
Land Use Inventory.

Output: Calibrated/Verified model for loads and stream response.

Suggested Methodology:

This study will be undertaken if water quality monitoring indicates that wet weather water quality is the problem indicated in the 208 planning effort. It is recommended that verified outputs be developed with the following considerations:

- Two separate outputs models be utilized, one can generate wasteloads for numerous storms inexpensively and one model of greater accuracy.
- The output model be tied to landuses and the portion of the output resultant from various landuses be available.
- The models be calibrated and verified.
- Loadings be tied to precedent rainfall conditions.

A calibrated/verified stream response model should also be developed in accordance with accepted techniques.

It is recommended that the models then be utilized as follows:

- Rainfall records for an extended period of time be utilized and wasteloads in accordance with these periods be generated with the less expensive model, utilizing precedent rainfall and rainfall event information. These will then be input into the water quality response model and the critical events denoted. The more expensive model can then be utilized for intensive investigation of the critical events.

Implementing Agency:

TDWR

Cost:	$150,000 - $200,000
Timing:	The study is an immediate action item.

Work Element:	Develop Nonsteady-State Model for Houston Ship Channel.
Applicability:	Houston Ship Channel.
Note:	The need for this study is dependent upon the results of wet weather water quality monitoring. Possible results:

Result of Monitoring	Decision
Stream Quality Equal to or Worse than Predicted	No Further Work
Stream Quality Better Than Predicted	Implement Study
Stream Quality Much Better Than Predicted	No Further Work

The actual Purpose, Scope and Methodology will be dependent on detailing of the monitoring data.

Work Element: Wet Weather Standards Evaluation

Applicability: All Classified Segments

Purpose: To determine wet weather water quality criteria to maintain uses that dry weather standards are based on.

Scope: Develop general parameters and average numerical values as well as minimum value/time relationships for nonsteady-state conditions which are capable of maintaining overall water quality consistent with defined steady-state conditions.

Inputs: Dry Weather Water Quality Standards For All Classified Segments.

Outputs: Parameters and numerical values for nonsteady-state conditions for all classified stream segments consistent with the overall objectives defined by the steady-state standards.

Suggested Methodology:

The methodology for defining the wet weather standards should be based on tolerance levels of representative aquatic species. Major efforts should be on literature review and input from the scientific community.

Timing: This study will impact directly on plan recommendations and controls. Initiate immediately.

Cost: Not Applicable, ongoing planning

Implementing Agency:

The TDWR is the most suitable agency to conduct this element since it involves standards.

Work Element: Set Dry Weather Water Quality Standards.

Applicability: Armand Bayou

Purpose: Determine water quality standards as part of classification process.

Scope: Evaluate potential of Armand Bayou to meet recommended fishable/swimmable criteria. Define parameter and numerical values for dry weather conditions consistent with defined uses.

Inputs: Proposed Steady-State Water Quality Simulation Model
Proposed Wet Weather Monitoring Data.

Outputs: Parameters and numerical values for Armand Bayou consistent with ultimate classification.

Suggested Methodology:

Utilizing the recommended steady-state water quality simulation model for Armand Bayou, evaluate the potential of meeting the presently recommend fishable/swimmable criteria, or alternate stream uses. Then develop water quality parameters and numerical values consistent with defined water uses.

Utilize recommended wet weather monitoring data for Armand Bayou to determine if defined dry weather uses are consistent with wet weather water quality.

Timing: This element is not critical to ongoing planning. Interim standards could be arbitrarily assigned with the understanding that final standards will be implemented in the 4-6 year time frame.

Cost: Not Applicable, ongoing planning.

Implementing Agency:

TDWR with input from the local agencies coordinated and affected entities.

Work Element: Set Dry Weather Water Quality Standards.

Applicability: Buffalo Bayou

Purpose: Determine water quality standards as part of classification process.

Scope: Determine parameters and numerical values for dry weather water quality, consistent with the recommendation for classification of Buffalo Bayou for non-contact recreation and preservation of bayou aesthetics.

Inputs: Expanded Houston Ship Channel model as presently recommended.
Proposed Wet Weather Monitoring Data.

Outputs: Parameters and numerical values consistent with recommended classification.

Suggested Methodology:

- Utilize local input from affected entities and public hearings, to develop initial target values.
- Evaluate these values through the use of the expanded Houston Ship Channel model to determine capability of meeting these values.
- Uncontrollable wet weather water quality should be evaluated since this may be the limiting factor.
- Overall evaluations should be coordinated by a water quality council with final recommendations to the TDWR.

Timing: This element is not critical to ongoing planning. Interim standards could be arbitrarily assigned with the understanding that final standards will be implemented in the 4-6 year time period.

Cost: Not Applicable, ongoing planning.

Implementing Agency:

Local agencies coordinated with TDWR acting on recommendations.

Work Element: Evaluate Alternative Water Quality Standards.

Applicability: Houston Ship Channel, Cypress and Clear Creeks.

Purpose: To set alternative dry weather water quality standards in those areas where existing techology or cost effectiveness for controlling wasteloads may not be feasible based on existing information.

Scope: Based on updated, calibrated and verified water quality simulation models, re-evaluate the projected water quality based on the existing wasteload allocations. In segments where existing water quality standards are not projected to be met, re-evaluate the alternatives of changing allocations and/or changing the standards.

Inputs:

Water Quality Monitoring Data
Updated Point Source Inventory
Updated Nonpoint Source Wasteloads
Calibrated/Verified Models

Outputs: Alternative water quality standards for applicable segments.

Suggested Methodology:

- Review water qualtiy monitoring data.
- Evaluate effectiveness of existing controls.
- Input updated data into updated simulation models and re-evaluate the projected water quality.
- Consider alternative wasteloads allocations where necessary.
- Evaluate cost effectiveness of meeting existing standards where applicable.
- Consider alternative standards where applicable.

Timing: This element is part of the plan updating. Implement as resources and inputs permit.

Costs: Not Applicable, ongoing planning.

Implementing Agency:

Local agencies to coordinate effort and petitioning TDWR for any changes in standards.

Work Element:	Evaluate Additional Dry Weather Standards
Applicability:	Lake Houston and Clear Lake Basins
Purpose:	Determine numerical standard for residual chlorine consistent with fishable/swimmable water quality and a healthy aquatic environment.
Scope:	Evaluate the potential toxic effect of chlorine and chlorine compounds on aquatic life, in order to develop numerical values for stream standard, which can be related to residual effluent levels if possible.
Inputs:	Updated Point Source Inventory
Outputs:	Stream standards and effluent standard for maximum levels of residual chlorine and chlorine compounds.

Suggested Methodology:

This effort should be initiated with a thorough examination of the literature resulting in initial stream standards. These stream standards should then be translated into effluent standards whereever possible.

Timing:	This element is not on the critical path for any other technical recommendation. Implement as resources permit within 1-5 year time frame.
Costs:	Not Applicable, ongoing planning

Implementing Agency:

The TDWR is the logical implementing agency. Initial efforts to define stream standards could be subcontracted.

Work Element: Update Point Source Inventory

Applicability: Multiple

Purpose: To maintain accurate and up-to-date data base for input to future planning efforts.

Scope: Develop a centralized data base of all municipal and industrial point source discharges in the combined designated/nondesignated 208 area.

Inputs:
Existing Point Source Inventory
Existing Waste Control Orders
NPDES Permits
Self-Reporting Data

Outputs: A complete listing of discharges in the 208 area along with location of discharge, volume, waste characteristics, etc., which can be utilized for plan update.

Suggested Methodology:

The existing inventory should be cross referenced with State and Federal permits issued for the area.

Water quality and flow characteristics can be cross referenced with self reporting data.

Timing: Due to its need for ongoing planning, it is recommended that this work element be initiated as time allows, within 1-3 years.

Costs: $ 20,000 - $30,000

Implementing Agency:

H-GAC is the logical implementing agency due to its existing planning activities.

Work Element:	Update Population and Land Use
Applicability:	Entire 208 Area.

Purpose: Develop mechanism that can be used to easily and inexpensively:

- Determine existing land use patterns for comparison to projected patterns and be used in ongoing planning.
- Compile land use data for various geographic areas.
- Evaluate alternate, projected land use patterns.

Scope: The geographic area should include the combined designated/nondesignated 208 boundaries as expanded to allow the mechanism to be useful in other planning programs. The mechanism should be capable of accepting land use data (or other data which can be used to generate land use estimates) generated in other programs or by other agencies, input this data, and provide land use by acre and type for geographic areas which can be selected by the user.

Inputs: Existing land use data and projections.

Outputs: Mechanisms (computerized) to store existing land use data and accept projected land use data. Program should be able to aggregate land use by area and type for any desired geographic area. Link with graphical plotter desirable.

Suggested Methodology:

Initially the specification for the mechanism must be written to make it as useful a tool as possible, the needs of several potential users must be identified. For example, both environmental and transportation planning extensively utilize existing and projected land use data. Among the items which should be tentatively identified at this time are:

- Geographic limits of study.
- Types of land uses/classification to utilize.
- Desirable grid size.
- Plotting necessary (yes/no)

- Anticipated update frequency.
- Intended uses of data (i.e. population, traffic density)
- Storage limits of available computer.

Once the specification is set, sources of information of land use, population and other required data. Examples of data source include:

- LANDSAT Satellite Aerial Photographs
- Public Works records on water or sewer connections.

Next available data handling systems should be investigated to ascertain whether one is suitable or easily modifiable for the intended use or whether a new software system must be built.

Finally, the actual mechanism should be developed. Clearly the mechansim must be both suitable for the intended function and compatible with the data sources. An example of a possible mechanism is as follows:

- Existing land use is obtained from LANDSAT.
- Land use is digitized into a grid system. Example p·x 102/418 is:

28	acres single family
6	multi-family
4	commercial
2	parks

(above assumes a 40 acre grid).

- Desired polygons are denoted (e.g. polygon including within the points 102/418, 102/444, 120/444, 120/426, 128/426, 102/426

and agglomerated land use is calculated. For example:

14020	single family
180	multi family
62	commercial
48	parks
8060	agricultural
1670	undeveloped

- Subroutines are utilized to calculate populations or other desired data.

The mechanism can have other features. For example, the City of Houston water use data can be used to determine number of users of different types within a polygon and this in turn used to estimate population which in turn can be checked against the land use based population estimates.

Clearly, the mechanism described above can be utilized in conjunction with projected conditions merely by encoding projected land use into the grid system.

Finally, a graphical plotter can be used in conjunction with the mechanism to produce graphical displays of land use.

Timing: Due to its need for ongoing planning, it is recommended that the land use mechanism be developed within three years.

Costs: Costs are highly dependent on the specification for the mechanism (tailor made program or minor modifications to existing program). Therefore the work must proceed in two steps:

• Develop specification/ Identify Data Sources/ Determine Software Availability	$10,000 - $20,000
• Develop mechanism	$20,000 - $100,000

Implementing Agency:

HGAC is the logical implementing agency due to its multi-desciplined planning activities.

Work Element: Update Nonpoint Source Wasteloads

Applicability: Multiple

Purpose: To better define existing sources and loadings of nonpoint source wasteloads.

Scope: Develop a data base relating origins of dry weather nonpoint source wastes and the respective contributions to the 208 area segments.

Inputs: Assessment of Nonpoint Sources
Nonpoint Source Sampling Design Report

Outputs: A more definitive identification of dry weather related nonpoint source wasteloads and the respective stream segments affected by the wasteloads. The results will be utilized to update the steady-state models where applicable.

Suggested Methodology:

The existing Nonpoint Source Assessment should be used as the basis for the study. Field sampling programs should be implemented to identify wasteload characteristics of specific nonpoint source wasteloads. Unitized factors should then be developed relating volume/origin of wasteload, relative distance/dispersion of wasteload, resulting wasteload characteristics, and resulting effects on water quality as determined by updated models.

Timing: Due to its input to ongoing planning and plan update, this work element should be initiated in the 2-5 year time frame.

Cost: $60,000 - $80,000

Implementing Agency:

H-GAC is the logical implementing agency due to its existing planning actions.

Work Element: Eutrophication Study Lake Houston.

Applicability: Lake Houston

Purpose: To verify predicted phosphorus loads and the level of phosphorus control required to prevent eutrophication.

Scope: Total point and nonpoint source phosphorus loads for the entire Lake Houston watershed are to be determined. The affect of this load on eutrophication and amount of reduction required for eutrophication to be addressed.

Inputs:
208 Nonpoint Source Analysis
208 Point Source Inventory
EPA Lake Houston Report
208 Technical Subplans.

Outputs: Report Detailing:

- Phosphorus loads to Lake Houston by source.
- Level of phosphorus loadings conducive with non-eutrophic conditions.

Suggested Methodology:

The basic study should be to confirm data already presented and available. As such it should develop annual loads to Lake Houston based on source of load. Stream monitoring data would be an ideal way to develop this data. The annual loading should then be analyzed to determine the degree of eutrophication resultant from that loading and the reduction required to have significant positive affects on eutrophication.

The study will be similiar to the Clear Lake Study except tidal affects are not applicable and, due to the long detention time in Lake Houston, temporal variations are not critical.

Implementing Agency:

Due to the City of Houston's interest in the Lake, that agency is a logical choice to implement the work. The optional choice is TDWR.

Cost:	$50,000 - $75,000
Timing:	The study is not critical. Five to ten year time frame is appropriate.

Work Element: Eutrophication Study.

Applicability: Clear Lake (Similar effort required for Dickinson Bayou)

Purpose: To define the Sources of phosphorus loadings to Clear Lake and determine permissable total loadings. The data to be utilized to ascertain whether point source phosphorus controls should be continued.

Scope: The entire Clear Creek watershed must be considered as well as phosphorus loading from Galveston bay through tidal movements. Information developed should allow predictions of phosphorus concentrations in the Lake with:

- point source phosphorus controls in the basin
- nonpoint phosphorus controls in the basin
- both point and nonpoint phosphorus controls.

These concentrations should then be compared to permissable concentration in order to avoid eutrophic conditions.

Because of its individual nature, Armand Bayou should receive separate attention. Loadings and concentrations should be determined along the length of the Bayou with various types of controls.

Inputs:

- 208 Nonpoint Source Assessment
- Report on Lake Houston Harris County Texas EPA Region VI Working Paper No. 647, March 1977
- Point Source Inventory
- Steady-state Models
- Nonsteady-state Models
- Wet weather water quality model
- Updated nonpoint source waste loads
- Clear Lake test area program
- Galveston Bay Study

Outputs: Report detailing:

- Phosphorus sources and loads
- Phosphorus concentrations with various categories of loads
- Allowable phosphorus concentrations.

Feasible Methodology:

The methodology should emphasize that this study is not merely one which is to be undertaken in the Clear Lake drainage basin. Therefore, the work plan and methods must be such that the data developed is useable in other studies. Certain elements of the work plan may be expanded to include other elements which, although not useable in this work, can be more cost-effectively undertaken as part of this study rather than in an independent study (for example, samples taken for phosphorus concentration of nonpoint source loads could be analyzed for other parameters to initiate the setting of, for example, BOD load) from these sources.

The study will have three main areas of emphasis: load determination, hydrology and modeling of the system and permissable concentration determination.

Load Determination

Loads must be determined from the following major sources:

Point sources
Dry weather nonpoint sources
Wet weather nonpoint sources
Tidal water

1) Point Sources. Sufficient treatment plants without phosphorus controls should be sampled to develop a typical loading from this source.

2) Dry Weather Nonpoint Sources. The major potential sources of this loading are: recreational activities and septic tanks. The minimum rice farming in the area is likewise a potential source. The loading due to recreational activity can be estimated from estimates of users of the recreational facilities, regulations on users (i.e. shipboard holding tanks) and other information. Septic tank loadings can be estimated from selective sampling of Streams draining areas served by septic tanks (i.e. samples above and below clusters of septic tank users. Rice field loadings can be determined

by direct sampling of rice pond discharges and knowledge of typical operation.

3) Wet Weather Nonpoint Sources. Direct sampling of rainfall run-off is required. Sampling should be sufficiently detailed to estimate loading rates from various type of land use. These loading rates should then be verified for climatic conditions other than those for which they were determined. Due to the ultimate use of the values, it is recommended that the loading rate be in a form suitable for use in a relatively inexpensive computerized mechanism such as the output block of STORM.

4) Tidal Loadings. Phosphorus concentration of tidal waters should be determined for Galveston Bay tidal waters. Sampling should not be only in the area near the Clear Creek discharge to the Bay but also beyond, since it is likely that a concentration gradient will be observed due to the phosphorus loading from the Creek itself.

Hydraulics and Modeling of the System

This activity will be the first in calibrating and verifying the wet weather water quality simulation model. The following should be achieved:

- Documentation of the hydraulics of the system for use in the model (primarily time of travel)

- Documentation of dispersion coefficients.

The above should be accomplished for Clear Creek to below the Lake and Armand Bayou. The result together with the load determining activity will be a "calibrated" model for the conservative substance for Clear Creek.

Once the calibrated models are developed, loadings should be imput to it to simulate an extended time period. That is, the rainfall (for example, a year) indvidual loads, dry weather nonpoint source loads (including seasonal variations)and point source loads should be input on a daily basis. Tidal loads can be taken into account by the dispersion coefficient and downstream boundary condition. The resultant phosphorus levels (the BOD simulation with a degradation rate of zero can be utilized) in Clear Lake will then be output from the model. The procedure should be repeated with the elimination or reduction of various types of loads (e.g.- reduce phosphorus from point sources to a level equivalent to effluent set 3NP treatment).

An exercise similar to the above can be repeated for Armand Bayou, only downstream boundary conditions are set at the Clear Creek modeled levels.

Determine Allowable Phosphorus Levels

The allowable phosphorus loading should be determined by experimental techniques. Initially, the Vollenweider model could be utilized. That model should be modified for conditions in this area.

A comparision of the allowable concentrations and the predicted concentrations can then be made to see what types of controls, if any, could be used to control eutrophication in the Lake and Bayou.

Cost: $100,000 - $150,000

Implementation Agency:

TDWR should undertake the model related study. Due to its urgency for timing, it is most desirable that a local agency be responsible for the load and allowable phosphorus determination. The City of Houston is presently conducting similar activities in the 208 study area and, therefore, that agency is the most feasible to undertake the local work.

Timing: The study and closely related studies are urgently needed, and therefore it is recommended that it be initiated in a 1-2 year time frame.

Work Element: Regionalization Opportunities.

Applicability: Multiple

Purpose: To evaluate economic incentives and water quality improvements associated with regionalized wastewater treatment facilities.

Scope: Develop a review/comment mechanism as part of 201 facility planning and other programs, to evaluate and recommend regionalization opportunities.

Inputs:
Updated Point Source Inventory
Updated Population/Land Use
Affected Grantees
Existing Review Agencies
208 Technical Subplans
Water Quality Models

Outputs: A mechanism for evaluation during the pre-grant or preliminary planning phase, of alternative treatment opportunities within the area. Recommendations to be implemented on a voluntary basis by actual grantees.

Suggested Methodology:

This work element will be a part of ongoing planning. The actual methodology will be developed as part of the first year program. However, the following elements should be considered:

- Emphasis should be placed on coordinating the efforts of potential 201 grantees in the pre-grant phase. If 201 Facility Planning Areas are expanded, regionalization opportunities can be more rigorously addressed.

- Estimates of priorities of grantees should be made for separate planning areas and combined planning areas. This could serve as an impetus towards combining Facility Planning Areas.

- H-GAC should make the water quality models and wasteload projections readily available to grantees.

- A mechanism to assist in coordinating on-going adjacent 201 efforts should be set up by H-GAC, to be used on a voluntary basis by 201 grantees.

- Emphasis should be placed in areas where regionalization has the greatest potential for cost-effectiveness and is then most difficult to implement due to multiple jurisdictions.

Timing: This is an ongoing activity to be initiated in the first year by a local coordination mechanism and continued thereafter.

Cost: Not Applicable, ongoing planning.

Implementing Agencies:

This will be a combined effort of H-GAC, and affected grantees, as part of A-95 review.

Work Element: Supplemental Aeration Study.

Applicability: Houston Ship Channel.

Purpose: To determine the cost effectivenss of utilizing supplemental aeration in the Houston Ship Channel to raise dissolved oxygen levels.

Scope: The amount and location of supplemental oxygen required to raise dissovled oxygen levels in the Ship Channel to desired levels is to be determined and the cost effectiveness of this solution analyzed.

Inputs:
Existing Non steady-state Model.
Updated Steady State Model.
208 Point Source Inventory and Projections.
Updated Nonpoint Source Inventory.
208 Technical Subplans.
GCWDA Aeration Study (Underway).

Outputs: Recommendations as to: location, type and amount of supplemental aeration for steady-state and wet weather conditions. Resultant stream quality. Cost of this solution versus costs of other solutions.

Suggested Methodology:

The Gulf Coast Waste Disposal Authority is presently undertaking a supplemental aeration study. It includes:

- Evaluation of amount of aeration under storm from conditions.
- Evaluation of location of aeration.
- Evaluation of alternate types of supplemental aeration.

A pilot study will eventually be undertaken.

Other special studies (wet weather monitoring, updating non steady-state model, updating steady-state model) will also have impact on this work.

This study should utilize input from the previous work to make specific recommendations to:

- Necessity of aeration.
- The amount of aeration required.
- The location of aeration.
- Cost of aeration.
- Feasibile methods of cost shaving.
- Excess assimilative capacity resultant from aeration.

The above should be addressed for dry and wet weather conditions.

Implementing Agency:

Gulf Coast Waste Disposal Authority.

Cost: Dependent on present GCWDA study.

Timing: 5 years +.

Work Element: Interbasin Transport Evaluation

Applicability: Clear Creek

Purpose: Determine whether major wasteloads can be economically transported out of the Clear Creek Basin without adverse affects on the adjoining basin.

Scope: The cost-effectiveness, environmental impact and political acceptability of transporting wasteloads at effluent set 2 treatment level out of the Clear Creek basin into the adjoining Houston Ship Channel basin. Major plants are to be addressed. The water quality affects of discharging to Clear Creek are to be compared to the affects in the adjoining basin.

Inputs:
208 Alternative Technical Subplans
Clear Creek steady-state model
208 Environmental Inventory
208 Land Use projections

Outputs: Decision on which plants should discharge to Clear Creek and at what treatment level and which plants should utilize interbasin transport and at what level.

Suggested Methodology:

This study can most effectively be addressed as part of the 201 planning efforts. The City of Houston's plants discharging to Clear Creek are the most likely candidates for interbasin transport, therefore, the Houston 201 efforts should address this problem. The following may be appropriate in that 201 effort:

- Water quality in Clear Creek with and without interbasin transport.
- Water quality in Houston Ship Channel tributaries with and without interbasin transport.

- Effects of transport of the Houston Ship Channel
- Effects of transport and flooding
- Feasibility of transporting only during critical times of the year.

If the City of Houston 201 shows that transport for these plants is cost effective and environmentally sound, a broader study addressing other point sources in the Clear Creek basin might be appropriate. This could serve as an inpetus towards regionalization of small plants.

Implementing Agency:

City of Houston, Other 201 grantees.

Cost: Not Applicable, part of 201 planning.

Timing: The Study is needed in the 2-5 year time frame.

Work Element: Impacts of Other Pollutants on Water Quality.

Applicability: Multiple

Purpose: To evaluate the effects on water quality created by pollutants not heavily considered during the initial 208 plan.

Scope: Evaluate the levels and effects of other pollutants such as heavy metals, toxic chemicals, and suspended solids on segment water quality in order to determine impacts on both dry and wet weather fishable/swimmable water quality.

Inputs:
Water Data Base
Assessment of Nonpoint Sources
Wet Weather Monitoring (proposed)
Existing Monitoring and Reporting Mechanisms
Wet Weather Water Quality Standards (where applicable)
Criteria Relating to Heavy Metals, Toxic Chemicals, and Suspended Solids etc.

Outputs: A reliable data base which can be used to assess water quality and the ability of meeting dry and wet weather standards where applicable.

Suggested Methodology:

The existing monitoring mechanisms and associated entities, coordinated by the TDWR should spearhead the effort, emphasizing the following:

- The relationship between pollutant loading and time following storm events.
- The allowable level of pollutants while maintaining standards. This is mainly a research activity.
- Identification of contributing sources or areas where possible.

Timing: This study is to be used as input to the plan update procedures. Initiate mechanisms as resources permit, 2-5 year time frame.

Costs: $50,000 - $100,000

Implementing Agency:

TDWR, coordination with local entities and existing mechanisms.

Work Element:	Analyze Nonpoint Source Controls
Applicability:	Clear Creek
Purpose:	To evaluate nonstructural control methodologies for reduction of run-off related nonpoint source wasteloads. Determine efficiencies of nonstructural controls in order to benefit from their low cost and maintenance and ease of implementation.
Scope:	The Clear Creek nontidal watershed is projected to have increasing problems related to stormwater runoff. Rather than implement expensive structural controls, nonstructural controls are recommended to be implemented in specific test areas where effectiveness can be monitored.

Strategies to be tested include:

- Best management practices.
- Vegetative control techniques.
- Small scale retention.
- No control (baseline information).

Inputs:	Assessments of Nonpoint Sources Control Strategies, Costs & Impacts For Nonpoint Sources Nonpoint Source Sampling Design Report Nonstructural Control Strategies For Nonpoint Sources of Water Pollution Supplemental Report Available Land
Outputs:	Documented evaluation of the effectiveness of nonstructural control strategies and recommendations concerning further applications.

Feasible Methodology:

The methodology for this study provides for the development of a data base which can be utilized in other ongoing planning efforts such as wet weather monitoring and update of nonpoint source wasteloads. Since the control strategies (with the exception of best management practices) require undeveloped areas of land, the study should also allow for additional amounts of land to be reserved in future developments. With these objectives in mind, the following steps are recommended:

- Select test areas
- Perform background sampling in test areas
- Based upon verification of high wasteloadings from urban runoff, reserve sufficient amounts of land for controls.
- Implement various nonstructural controls in selected test areas.
- Monitor effectiveness of any existing controls and controls that are implemented.

Timing: Since a wet weather water quality problem is projected to begin in the 1983-1990 time frame and the low cost, easily implemented nonstructural control strategies require additional amounts of land to be reserved, the application of control strategies should be planned for as soon as possible. It is recommended that this study and its closely related studies be initiated in a 1-2 year time frame to avoid nonpoint source pollution that may be extremely expensive to correct or become an irreversible problem.

Cost: $75,000 - $100,000

Implementing Agency:

The H-GAC can provide overall coordination in the selection of test areas with local agencies implementing the evaluation.

Work Element: Evaluate Desirability of Classification of Bayous.

Applicability: White Oak, Brays, Sims, Vince, Hunting, Greens/Halls, Carpenters Bayous.

Purpose: Continual evaluation of water quality, water uses, and waste treatment costs associated with classification of individual segments.

Scope: The initial evaluation indicates these bayous are effluent dominated during dry weather and storm water dominated during wet weather and do not hold significant recreational potential. As further information is developed during the plan update, the desirability of classifying individual segments will be determined by comparing water uses to costs of achieving water quality consistent with those uses.

Inputs: Expanded Houston Ship Channel model as presently recommended.
Proposed wet weather monitoring data.
Facility planning information.

Outputs: Determination of bayous desired for classification.

Suggested Methodology:

The expanded Houston Ship Channel model will provide a more reliable means of determining each bayou's assimilative capacity. Utilizing wet weather monitoring data, determine if dry weather uses are consistant with wet weather water quality. Refer to local input from affected entities, Facility Plans, and public hearings to determine public sentiment, environmental impacts, and costs of wastewater treatment on the bayous.

Timing: This element is part of the plan updating. Implement as resources and inputs permit.

Cost: Not Applicable, ongoing planning

Implementing Agency:

Overall evaluations should be coordinated by the H-GAC with final recommendations to the TDWR.

Work Element: Evaluate Non-Water Quality Impacts of Nonpoint Source Loads.

Applicability: Multiple

Purpose: To identify and evaluate the impacts of nonpoint source loads on factors other than water quality and determine necessity for controls.

Scope: Emphasis should be directed toward construction or development related erosion due to stormwater run-off and the related problems, i.e. flooding.

Input:
Assessment of nonpoint sources
Updated land use
Nonpoint source control strategies

Output: A reliable evaluation of the necessity and effectiveness of erosion controls for construction related activities.

Suggested Methodology:

H-GAC along with local agencies should spearhead the evaluation effort.

First, select test areas for evaluation. At least three sites will be required. One site should be a natural, undeveloped area. A second site should be an area currently under heavy development but without erosion controls. The third site should be a developing area incorporating erosion controls. Additional sites might include alternate erosion control techniques.

Some of the easier implemented erosion control techniques to be evaluated include:

a) Vegetation, seeding with fast growing annuals
b) Diversions, grading and contouring land surfaces to reduce run-off velocity

c) Bench Terraces. Flat surfaces constructed on sloping land to reduce run-off velocity and filter out soil and silts.

Stormwater run-off should be monitored from the test sites. Data collected should include run-off volumes, velocities, total solids, etc. Additional data such as BOD, fecal coliform, heavy metals, pesticides, etc., might be useful in other studies recommended in the area. Analysis of the data should allow for a reliable evaluation of the impacts of construction related erosion and some of the recommended control strategies.

Timing:	This item is to be used as input to the plan update procedures. Initiate as resources permit, 3-5 year time frame.
Cost:	$40,000 - $50,000

Implementing Agency:

H-GAC coordinated with local agencies.
Possible inputs from local universities.

Work Element: Nonpoint Ordinance Analysis

Applicability: Multiple

Purpose: To catalogue and analyze all existing nonpoint source controls presently in effect in the 208 area.

Scope: To determine what ordinances and authority local entities and/or agencies presently have for controlling nonpoint source waste loads.

Inputs: Existing ordinances, legislated authority, etc.

Outputs: A single document identifying areas with existing control ordinances and an analysis of evaluation of their effectiveness.

Suggested Methodology:

Through questionaire or direct interview, review with all local entities and agencies their respective authority for nonpoint source controls or related ordinances.

Timing: This is required as part of plan implementation but not on the critical path. Initiate as time and resources permit, 3-5 years.

Costs: $5,000.00 - $10,000.00

Implementing Agency:

H-GAC

Work Element: Map All Water Districts.

Application: Multiple

Purpose: To develop a reliable data base concerning existing and future municipal service areas.

Scope: To develop a single up-to-date source for relating and monitoring the relationship between served and unserved population within the 208 area.

Inputs: Point Source Inventory
Land Use Map
Waste Control Orders

Outputs: A set of maps showing all water district boundaries.

Suggested Methodology:

Through questionaire and/or direct interview, physically plot the existing water district service areas on maps. Update as necessary due to formation of new districts or expansion of existing districts.

Timing: This is required as part of plan update, initiate in 2-5 year time period.

Costs: $5,000.00 - $10,000.00

Implementing Agency:

H-GAC

APPENDIX B

REVIEW OF 208 PROGRAM COST DATA

General

During the evaluation of the alternative technical subplans, questions arose concerning the accuracy of the capital and operational and maintenance costs for both plant and collection system. At that time, it was indicated that although the costs presented may be lower than anticipated, it would not greatly affect the selection of a recommended alternative. Additionally, H-GAC Staff along with Roy F. Weston, Inc., indicated that alternative sources of cost information would be investigated so as to verify or update the cost information presented in the Point Source Analysis Report. The results of the investigation will be utilized during the implementation portion of the 208 program.

Sewage Treatment Plant Capital Cost

Most of the capital cost curves presented in the Point Source Analysis were derived from information published by the National Commission on Water Quality in a report titled Water Pollution Abatement Technology, Capabilities and Costs, Publicly Owned Treatment Works. A review of the original report indicates that the capital cost for each unit process include land costs, labor costs, and material costs for the following:

1) Structures
2) Equipment
3) Pumps
4) Internal Piping
5) Appurtenances

Also included is an additional 25 percent allowance for engineering, contingency, legal, interest during construction, etc.

Not included in the capital cost curves are such things as site work, yard piping, support buildings, general electrical and HVAC. Available EPA publications indicate that these additional items will increase the capital cost by approximately 20 percent.

When the Point Source Analysis capital cost curves are increased by 20 percent to account for those items previously discussed, the overall treatment plant capital cost estimates compare favorably with other available data sources including published EPA estimates and

Roy F. Weston, Inc. information. Therefore, during the implementation phase of the 208 program capital cost estimates will be based on the data presented in the Point Source Analysis, plus an additional 20 percent to account for activities in support areas.

Sewage Treatment Plant Operational and Maintenance Costs

Nearly all of the sewage treatment plant operational and maintenance cost estimates presented in the Point Source Analysis were derived from the same NCWQ report previously described. Estimates obtained from the curves was compared to actual operating data for 1977 provided by Gulf Coast Waste Disposal Authority by the following method:

1) Three treatment plant sizes were investigated, 0.1, 0.5, and 1.0 mgd.

2) GCWDA data was identified as either fixed or variable.

3) Variable costs were unitized to account for treatment plants operating below their design capacity.

4) The sum of the fixed and variable components were compared to the Point Source Analysis cost curves.

Table 1 presents the comparison of operational and maintenance costs. It should be noted that only sludge disposal and chlorine costs were considered as variable components when analyzing the GCWDA data. Therefore, the actual O&M costs for GCWDA plants operating at capacity may be somewhat higher than calculated. However, Table 1 indicates that the H-GAC cost curves estimate are in line with actual operating experience for small plants in the 208 area.

The O&M costs presented include such items as labor, chemicals, power, laboratory, supervision, and minor materials. The costs do not include expenses for major items requiring maintenance or replacement, such as; pumps, valves, motors, recording equipment, electrical equipment and general maintenance on structures. It has been the experience of Roy F. Weston, Inc. that these related O&M expenses range from 1 to 2 percent of the capital cost per year. Therefore, the total annual O&M expenses to be used during the implementation portion of the 208 program will be the O&M costs from the Point Source Analysis plus 1.0 percent of the previously discussed capital cost.

TABLE 1

COMPARISON OF CGWDA DATA TO H-GAC COST CURVES

GCWDA Plant		Actual O&M $/yr.		Unitized[2] O&M $/yr.		Total Annual O&M $/yr.	
Capacity	Flow	Fixed	Variable[1]	Fixed	Variable	CGWDA	H-GAC[3]
0.1	0.085	21,600	2,480	21,600	2,920	24,500	34,000
0.5	0.375	27,800	5,760	27,800	7,700	35,500	56,000
1.0	0.475	53,800	6,580	53,800	13,900	67,700	70,000

[1] Variable costs include chlorine and sludge disposal.

[2] Unitized cost for variable portion =

$$\frac{\text{(Actual Cost)(Plant Capacity)}}{\text{(Actual Flow)}}$$

[3] See Figure 1.

Conveyance System Capital Cost

The conveyance system capital cost utilized for the Alternative Technical Subplans were developed by Roy F. Weston, Inc. from data obtained from the City of Houston and EPA cost curves. These costs were for sewers only and did not include lift stations or associated pumping facilities.

The additional capital cost associated with lift stations has been estimated using the Point Source Analysis cost curves and the following assumptions.

1) Every 2000 people require on lift station.

2) Average flow equals 0.2 MGD.

3) Peak flow equals 0.4 MGD.

(4) Average TDH = 30 feet

Based on the assumptions and cost curves, conveyance system lift stations increase the capital cost by approximately $40 per person. This brings the total capital cost estimate for new conveyance systems to $220/capita.

Conveyance System Operational and Maintenance Costs

As discussed in the conveyance system capital cost section, lift station were not included in the cost estimates. Based on available EPA cost curves, intermediate wastewater pumping is estimated to add an additional $0.62 per capita per year to the conveyance system O&M.

Including the originally estimated value of $0.87 per capita per year for the sewer system, the new total annual O&M for the conveyance system is estimated at $1.50 per capita per year. This new value will be utilized in the implementation portion of the report.